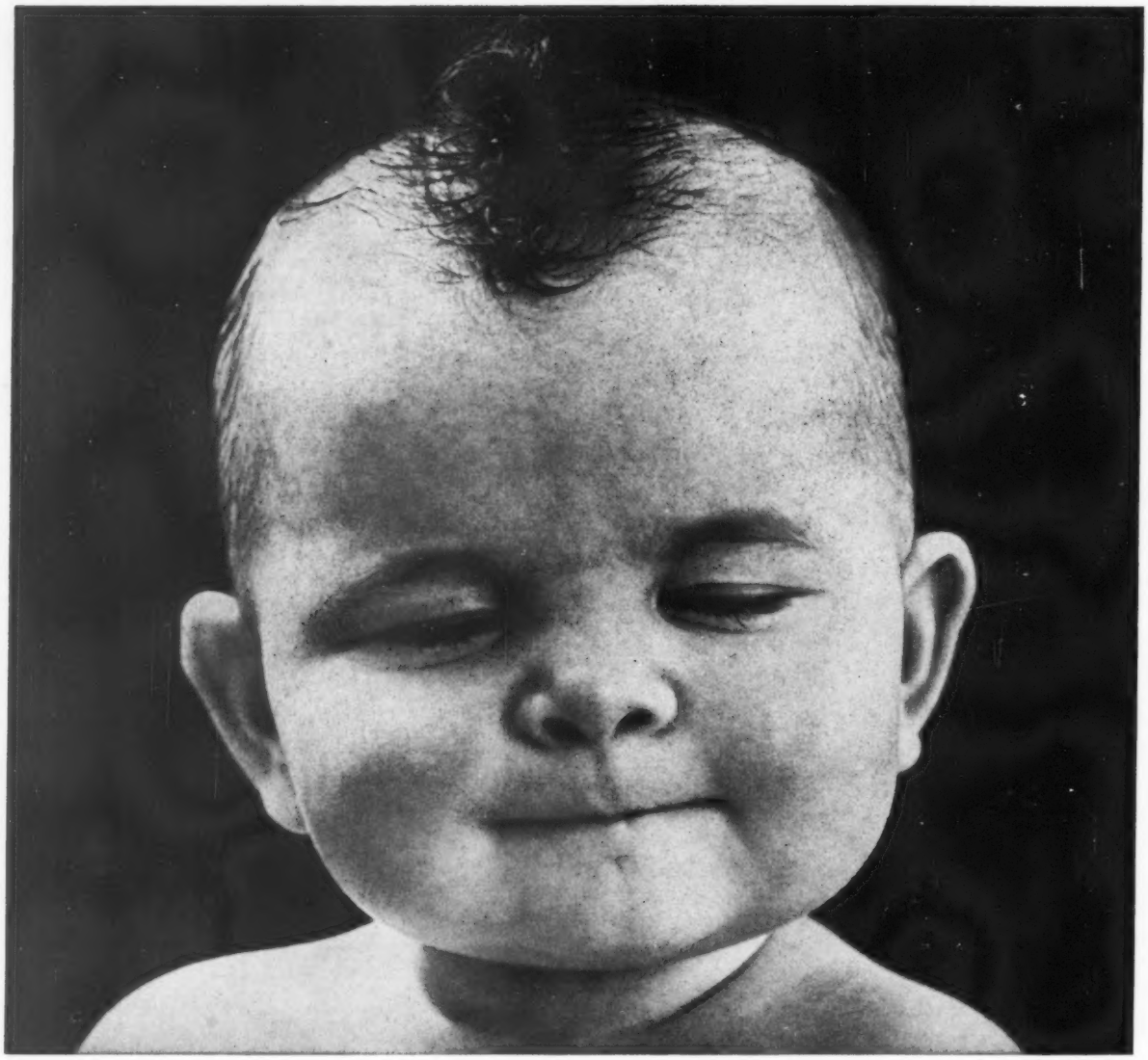
METAL INDUSTRY

THE JOURNAL OF NON-FERROUS METALS



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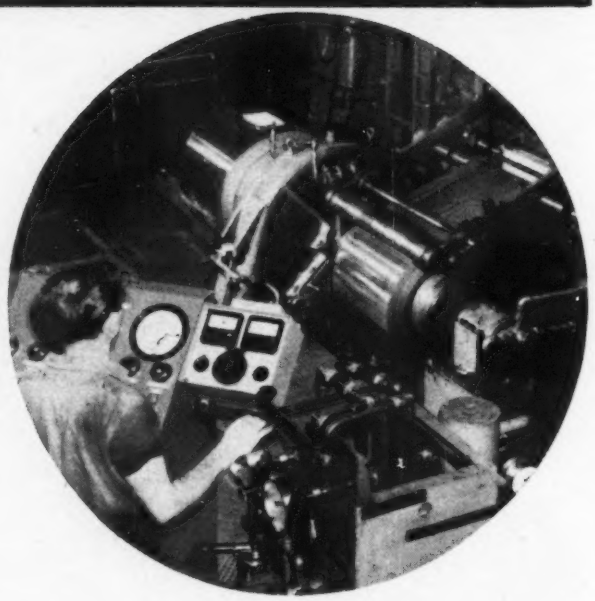

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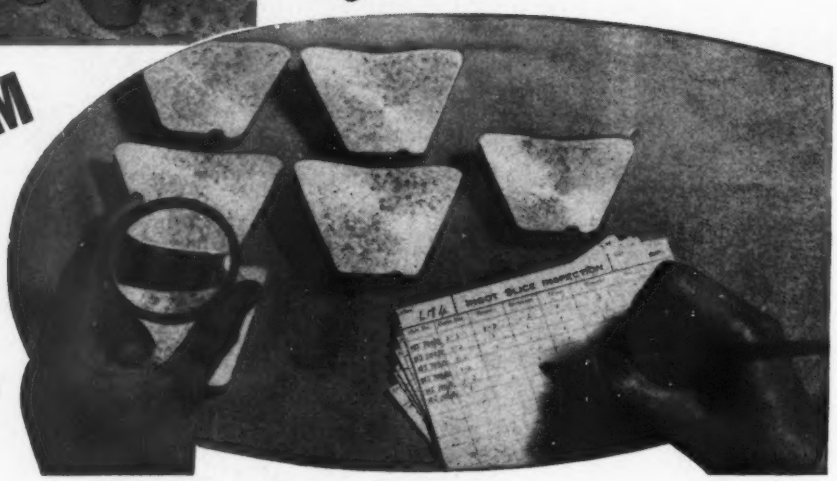

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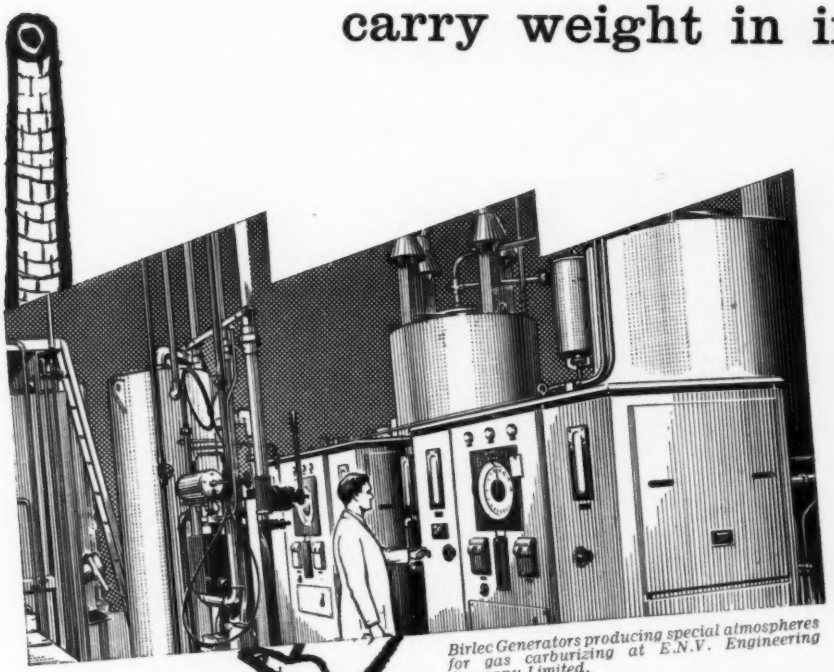

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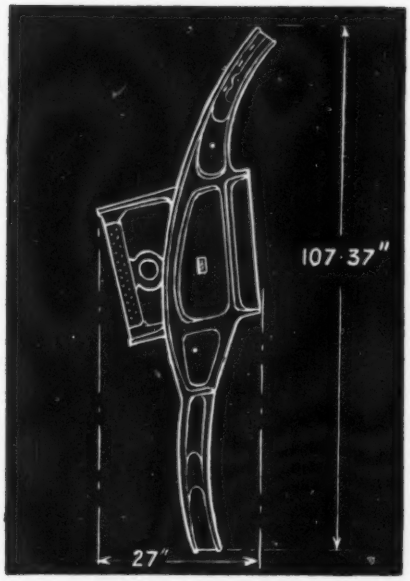

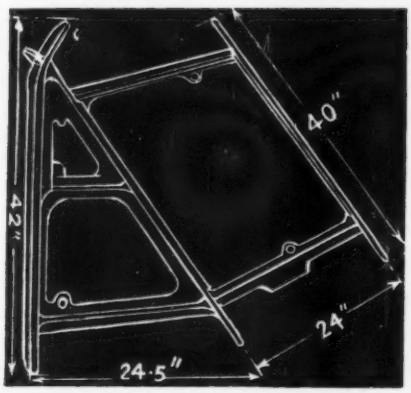

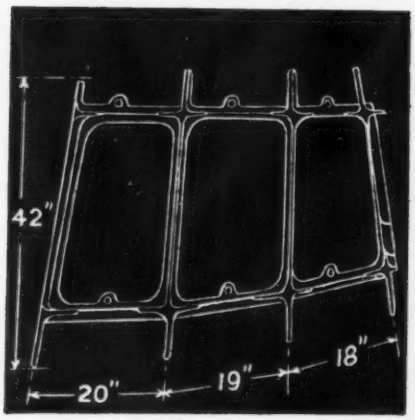

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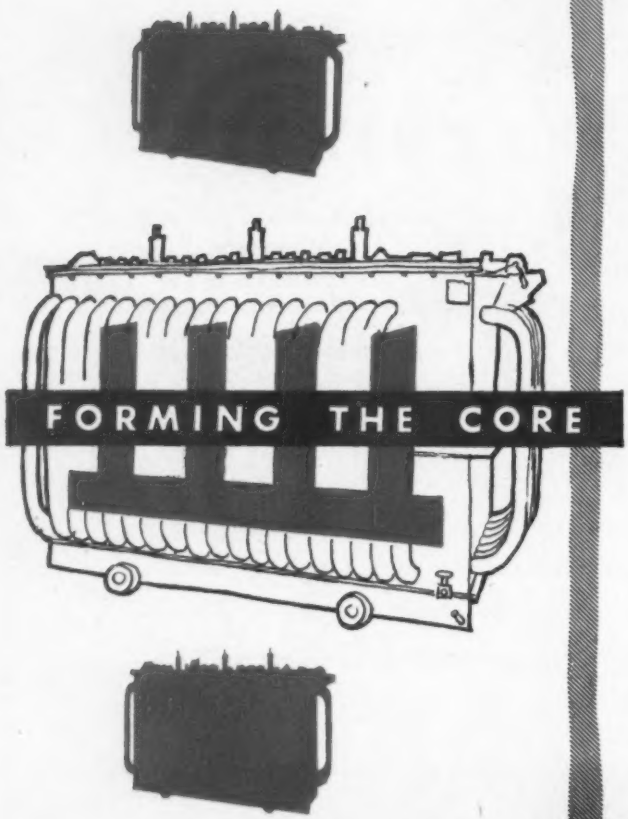

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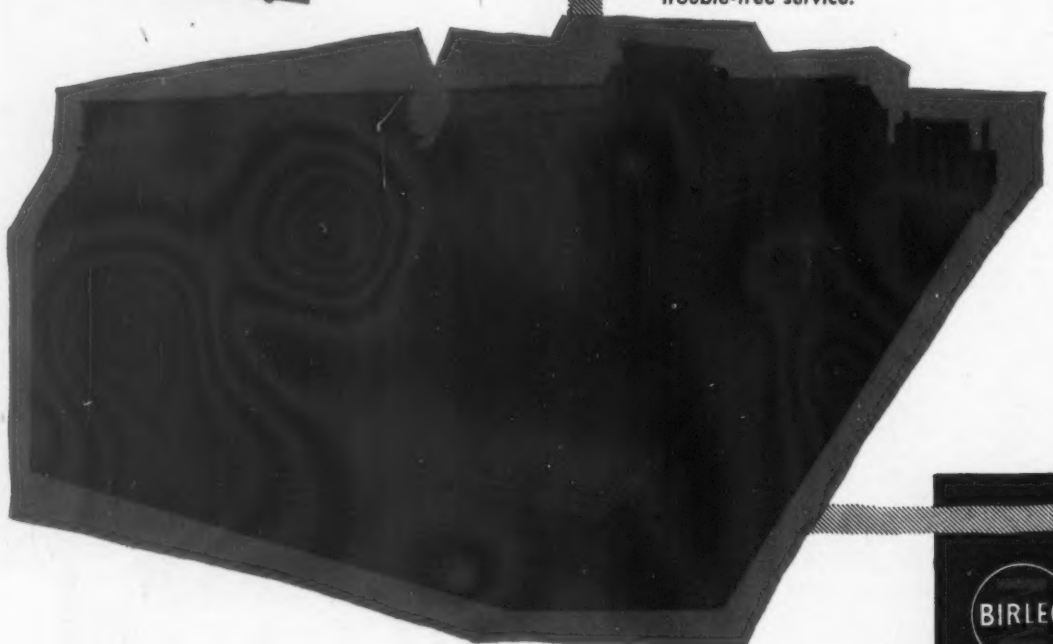

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METAL INDUSTRY

VOLUME 95 NUMBER 6 18 SEPTEMBER 1959

Tin Futures

ONE of the main features of the tin market during these past weeks has been its price stability in view of developments which could well have depressed it. The increase in the production quotas of 5,000 tons for the last quarter of the year was higher than the market had expected, as the continuation of the steel strike in the U.S.A. had much reduced buying from that country's consumers. The new rise in the permitted production among the I.T.C. countries is the third, and the largest, that has taken place this year, representing an increase of fifty per cent in nine months. The present quota is 77·5 per cent of the 154,938 tons of exports attained in the year prior to control. The prospects of supply and consumption being in balance during the coming twelve months is one which will be bound to occupy the minds of the industry, and these prospects are the subject of the monthly review of the market produced by *A. Strauss and Company Limited.*

On the present basis of export quotas, says the review, the tonnage of metal coming from the I.T.C. countries should be 120,000 per annum, but already here a doubt arises. Malaya, Nigeria and the Belgian Congo will have no difficulty in achieving their new quotas, but, Strauss and Company ask, will Bolivia, Indonesia and Thailand, who, between them, will now be entitled to export 56,000 tons a year? This is 18,000 tons more than the rate of their permissible exports during the first quarter of the year. While there is no positive evidence that this additional amount will not be fulfilled, it is known that production equipment and facilities have greatly deteriorated in some of these countries over recent years. It is, therefore, a pertinent question whether they will be able to effect such a substantial increase in their production rates, at least during the first part of the period under discussion. Moreover, these countries have parted with most of their minehead stocks through barter deals, out of which early shipments could have been made against the increased quota.

It is known, continues the review, that exports from the countries not included in the agreement will be about 10,000 tons but, it asks, what about Russia and China? The former is entitled, under its arrangements with the I.T.C., to export up to 13,500 tons this year, but so far it has kept much below that figure. With increasing internal consumption and the probability that the previous flood of exports was drawn from accumulated stocks, it is reasonable to assume that her exports will continue to be low. China is an unknown factor and there are no data on which to base an estimate.

The review then goes on to consider the other side of the picture, where much depends on the duration of the steel strike in the U.S.A. Consumption there, based on the first six months of the year, should be about 58,000 tons for the ensuing twelve months. It is only if the strike is gravely prolonged, and the existing stocks of tinplate become exhausted, that the ultimate sale of tinned goods will be affected. There has recently been a marked improvement in European demand and industrial activity generally. The review, therefore, taking all possible figures into consideration, estimates that consumption for the year should be about 148,000 tons against 140,000 tons available supplies. The deficit can be met without difficulty by sales from whatever amount the buffer stock manager has left and by further increases of production from the I.T.C. countries.

Out of the MELTING POT

Somewhat Shaken

WHERE something is quite clearly being wasted, there is always to be found the difficulty of deciding whether the waste is allowed to continue because there is no substantial economic incentive for stopping it, or because there is no known method by which the waste could be stopped or the waste product recovered. There is, of course, the other possibility that there exists an economic incentive for not stopping the waste. Given the latter situation, no improvements in or relating to methods could hope to be successful unless the said methods were, in fact, methods of increasing the waste, though whether such methods would constitute patentable inventions is beyond the scope of our immediate considerations. These considerations were started off, in the present instance, by the problem (if problem it is) of the waste (if waste it is:—it all depends presumably on what you call waste) of tin on tinplate used for cans. Not, incidentally, the problem in general, but the problem in particular as it is presented by the figures according to which the total tin consumed in 1958 in the U.S.A. in the manufacture of tinplate was 47,700 tons, of which 61 per cent was primary tin. In the same period, the amount of tin recovered from new tinplate clippings was only 3,300 tons, while the tin recovered from old tinplate containers added up to the staggering total of 20 tons. There only remains to decide whether it is the economists or the inventors who ought to feel staggered.

To Wait ?

SOONER or later, dimensional control over the etching liquid used in chemical machining is certain to be introduced, so why not anticipate the fact by giving the matter some thought before it is too late? Essentially, the dimensional control referred to is not so much a matter of dimensions measured in inches, as of their number, of which for practical purposes there are three. The dimensional control, in this sense of the term, at present exercised over the etching liquid in chemical machining has just about reached the first dimension. This is the control provided by the masking of portions of the surface of the work. Once the work has been immersed in the etchant, and once the latter has got beyond the surface, control is largely lost and undercutting and other forms of uncontrolled attack limit the depth to which etching can usefully be carried. Jets of etchant provide some measure of control, though once the jet has impinged upon the surface of the work, most of this control is lost. A much more definite dimensional control will have to be sought (and this is where the future grandiloquent announcement is being anticipated) by film or layer etching or chemical machining. To understand the principle, picture a cylindrical hole, the depth of which is to be increased by etching. A pipe extending to the bottom of the hole continuously feeds the etching fluid into the hole. The depth of the film or layer of etchant over the bottom of the hole is controlled by the position of the end of a suction tube (which tube may be concentric with the feed tube) through which the etchant is removed, to be returned to a suitable reservoir, filtered, made up if necessary, and recirculated. The effect of this arrangement is that the bottom and the wall of the hole are exposed to the controlled etching action of a constantly renewed layer of etchant, say $\frac{1}{4}$ in. deep. As etching proceeds, the feed and suction tubes are advanced together so as to maintain the relative positions of their ends, and thereby the depth of the layer of etchant. The result should be a cylindrical hole of any required depth. Then, again, picture an inclined plane with an unmasked strip of constant width extending down the incline and a film of etchant running down over the surface. Then, again . . . or perhaps somebody else can be left to do the thinking and development, and also to make the grandiloquent announcement?

Not Wanted

A WIDELY-HELD view is that cavitation plays a substantial part in the process of ultrasonic machining of solids in a suspension of an abrasive. Some authorities have even suggested that the removal of material is wholly due to cavitation. Very welcome and very definite evidence in regard to this opinion has recently been obtained by the Russian investigator, N. M. Rostovtsev. This decisive evidence was obtained in experiments in which ultrasonic machining was carried out under increased hydrostatic pressure. It is well known that an increase in the hydrostatic pressure beyond a certain value is a radical means of suppressing cavitation. In the apparatus used, the half-wave concentrator of the ultrasonic generator extended into a pressure chamber and into contact with the workpiece immersed in a suspension of boron carbide powder in water, ethyl alcohol or a saturated solution of common salt. The hydrostatic pressure of the suspension could be controlled and varied by admitting compressed air into the chamber at the required pressure. Two diverse materials—glass and aluminium—were chosen for the specimens to be machined. The amount of material removed by the ultrasonic machining under different hydrostatic pressures was determined by weighing the specimens before and after machining (for 2 min. in the case of glass and $3\frac{1}{2}$ min. in the case of aluminium). The results (weight of material removed in milligrams) were plotted against the hydrostatic pressures. In all cases the curves showed that the amount of material removed increased rapidly with increasing pressure, reaching a maximum beyond which there was no further variation of the amount of material removed with pressure. The points of inflection at which further increase in the amount of material removed with increasing pressure ceased were found to occur at the hydrostatic pressures which, according to calculation, should have been just sufficient to suppress cavitation in the various liquids: 6·3 atm. for alcohol, 9·4 atm. for water and 13·9 atm. for the salt solution. These pressures were independent of the material being machined. The unfavourable effect of cavitation is considered to be due to the incomplete filling with the abrasive suspension of the working space between the tool face and the work when cavitation is occurring. This reduces the supply of fresh abrasive and interferes with the removal of the particles of abraded material.

Skimmer

Finishing Supplement

Sealing Anodized Aluminium

By J. M. KAPE, B.Sc., A.R.I.C., L.I.M.
[(*Chief Chemist, Alumilite and Alzak Ltd.*)

IT is common practice to seal anodized aluminium to preserve the properties of an anodized coating for service applications—and uses involving the use of unsealed films are generally limited to those where the sealed film would not have such a hard or abrasion-resistant surface as in the "as-anodized" condition.

Until recently, the subject of sealing anodized aluminium has been rather a "closed book"—and one upon which few people had more than a working knowledge. Sealing was understood merely to close the pores on an anodized film, either by hydration (water sealing) or by mechanical plugging (oil or lacquer sealing). Unfortunately, from the point of view of the anodizing trade and related consumer industries, the subject was found to be far from simple, as was first thought.

Two methods for testing sealing efficiency are loosely described in B.S.1615 (1958) "Anodised Aluminium" one under the heading "Resistance to Leaching" (Section 11), one under the heading "Resistance to Stains" (Section 12). The word "sealing" is not mentioned in Section 11 and only indirectly in Section 12. Section 12 carries two alternatives (a fingerprint test and an absorption of dye test). Neither test is suitable or adequate for testing the *degree* of sealing of anodized work, as fairly indicated in the note after Section 12, which reads: "These tests will normally indicate whether a sealing process has been carried out or not, but may not always distinguish between adequate and inadequate sealing treatment. Efficient sealing has a significant effect on the corrosion resistance of the anodic film."

The latter sentence is most certainly true. Sealing influences the electrical properties of the coating as well. It is, perhaps, due to the many new applications of anodized aluminium, particularly in the architectural field, that the importance of good sealing has been realized. Unsealed or inadequately sealed anodized aluminium is subject to very rapid and disfiguring attack by sulphur dioxide, and such material exposed to an industrial atmosphere containing moist sulphur dioxide develops a white haze or bloom—even a chalky or powdery coating. This effect was noted in a Paper by Flusin,[1] and the only way of counteracting it is properly to seal the anodic film.

The proper ways of sealing an anodic film are well known, and the reasons why coatings so sealed perform well in service conditions are more or less understood. Which sealing treatments can be classed as inadequate is, however, in doubt.

Altenpohl[2] has described the various hydrolysis products of alumina films. At room temperatures and up to 75°C. the reaction with water (assuming the anodic film is Al_2O_3) is such as to give $Al_2O_3.3H_2O$ ("bayerite"). This is a loose white substance, being the main product formed when aluminium corrodes in many aqueous media. Above 75°C., the reaction of water (or steam) with the anodic film causes the formation of Bohmite—$Al_2O_3.H_2O$. Bohmite can exist in two forms—a type soluble in acids and a type soluble only with difficulty. The soluble changes to the insoluble only after boiling in distilled water for several hours, and this reaction does not occur in "hard" tap water. Moreover, Bohmite formation occurs between *p*H 4·5 and *p*H 8·5, and mainly between *p*H 5 and 7. It is to be concluded, therefore, that good sealing—to form the chemically resistant Bohmite—occurs in boiling distilled water at around *p*H 6, and this, of course, is recommended practice.[3]

There are, however, many other methods of sealing, recently adequately summarized and discussed by R. C. Spooner,[4] and many of these do not necessarily confer much additional durability upon the anodic film. Nowadays, owing to the many new uses of anodized aluminium, it is necessary, where possible, to specify the degree of sealing relative to a particular application. A sealing treatment standardized for dyed cosmetic containers which may be: 2 min. 1 per cent nickel acetate, *p*H 5·6, 80°C., followed by 5 min. mains water, *p*H 5·6, 85°C., would most certainly not be adequate for bright motor car trim. It is probable, however, that such work would easily pass the "fingerprint test" of B.S.1615:1958.

Recently, several tests employing the direct use of sulphur dioxide have been proposed for testing the efficiency of sealing on anodized work. A. W. Brace and K. Pokock[5] described a sulphur dioxide humidity test for determining sealing efficiency. Anodized and sealed panels exposed for 24 hr. in the humidity chamber developed a white haze or bloom, if incorrectly sealed, whilst panels correctly sealed had, at most, a light bloom.

Correct sealing methods resulting from these tests were: (i) distilled water, *p*H 5·5, 100°C., 20 min.; (ii) steam, 100°C., 20 min.

"Incorrect" methods were: (i) Distilled water, *p*H 5·5, 80°C., 20 min.; (ii) distilled water, *p*H 4·0, 100°C., 20 min. Other SO_2 humidity tests[6,7,8] yield essentially the same results. Results from various mains waters and using dyed work were not reported. R. C. Spooner[4] has described other methods for evaluating sealing efficiency. These were: (a) resistance to 5 per cent v/v sulphuric acid (weight loss measured); (b) cathodic current in 2 per cent v/v nitric acid (current flow after 180 sec. measured); (c) acidified salt spray test[9,10] (No. of pits and degree of staining recorded after 110 days); (d) outdoor exposure. He concluded that as a result of this work using these various tests, the *p*H value (of a sealing bath) should be over 5, but variations between 6 to 9 did not exercise a great effect. He found little difference between hard Kingston (Ontario) tap water and demineralized water.

It is considered that a test for sealing efficiency employing sulphur dioxide is the one which may correspond best with conditions of outdoor exposure, with the possible exception of a marine atmosphere. To this end, the results of SO_2 humidity tests may be useful and valuable contributions when correctly interpreted, but the plant can be expensive to construct, the method is time-consuming to operate, and large parts could not be tested *in situ*. Moreover, the results obtained are such as to need a skilled operator to interpret a "failure" from a "pass."

The work described below was undertaken in order, first, to examine methods of sealing popularly used in the anodizing trade (particularly mains water) and compare accepted methods of good and supposedly bad sealing obtained by the various techniques described earlier.

Secondly, a rapid solution-SO_2 type test was devised, the results from which correlated with existing work as to what was good and what was bad sealing and this was used to examine a very comprehensive range of sealing treatments, and several mains waters, in order to see just how far such sealing treatments were inadequate relative to modern service conditions.

Weight Gain Experiments

Panels of 99·8 per cent aluminium (3 in × 2 in × 16 S.W.G.) were chemically polished in a phosphoric acid base solution, anodized for 1 hr. at 20°C., 15 per cent w/w sulphuric acid, 15 amp/ft² to give a 0·001 in. anodic film and sealed by one of the following methods, used for 2, 5, 10, 20 and

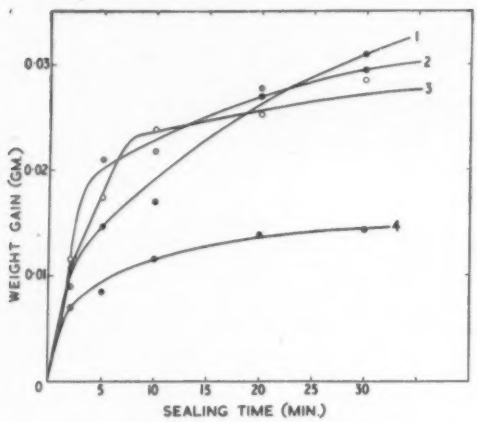


Fig. 1—Weight gains for four sealing treatments

1—Distilled water 100°C., pH 5·6
2—Distilled water 80°C., pH 5·6
3—Metropolitan Water Board supply 100°C., pH 5·6
4—Distilled water 100°C., pH 4·0 with sulphuric acid

30 min. The panels were weighed before and after sealing. Most of the experiments were done in quadruplicate. (1) Boiling distilled water, *p*H 5·6. (2) Distilled water 80°C., *p*H 5·6. (3) Boiling distilled water, *p*H 4·0. (4) Boiling mains water, *p*H 5·6 (Metropolitan Water Board).

The averaged results for these four sealing treatments are shown in Fig. 1, where weight gain or sealing (in mg) is plotted against time of sealing (in minutes). It can be seen that, whereas there is little difference between boiling mains water and 80°C. distilled water, the 100°C. sealing causes less weight gain up to 20 min., and the *p*H 4·0 water gives an altogether different rate of increase.

The rate of increase in weight on sealing in distilled water gives a curve indicating that sealing at 30 min. has only clogged the pores in some manner to a certain degree, and it is possible that sealing could go on for many hours, with considerable further increases in weight. The shape of the curves for the other sealing treatments, however, seems to suggest that, after 30 min. only, small increases in weight will be recorded for sealing for longer periods, and the film is effectively "saturated" — plots of $\log_{10}$ (time of sealing) against weight gain confirm this view.

Resealing

The gain in weight on resealing "incorrectly" sealed work may be indicative of the initial degree of sealing. The method of resealing was, however, found to affect the results. Panels of 99·8 per cent aluminium, anodized to 0·001 in., in the fashion previously described, which had been sealed by four different methods for various times, were resealed in steam. Completely haphazard results were obtained on duplicate sets of panels, and the results are shown in Table I. Weight changes are recorded in mg. as + (gain) or − (loss).

Further experiments were carried out on 0·0005 in. bright anodized D.57S (Northern Aluminium Co. Ltd., 1¼ magnesium + super pure aluminium-base alloy), which had been initially sealed in distilled water 30 min., 100°C., *p*H 5·6 and *p*H 4·0. Resealing methods employed were steam, and distilled water, *p*H 5·6, 100°C., 20 min. Again, no coherent results on re-steam sealing were obtained, but resealing in distilled water gave more sensible answers, although results were not in exact agreement on duplicate runs. Here, the resealing weight increased as the time of initial sealing decreased.

Chemical Dissolution Method

A method of caustic soda penetration of anodic films to determine their corrosion resistance has been used by S. Tajima, Y. Kimura and T. Fukushima.[11] Their results are summarized in a recent review,[12] and show that steam sealing considerably improves the corrosion resistance of anodic coatings prepared in various electrolytes.

It was considered that the method was applicable to distinguish between variously sealed specimens, and some 99·8 per cent aluminium panels were anodized at 12 amp/ft² for 1 hr. in 15 per cent w/w sulphuric acid at 20°C., and sets of panels were sealed by the various methods described before.

The panels were treated with drops of 10 per cent caustic soda at 22°C., and the time to evolution of a considerable amount of gas bubbles noted. Breakdown was when "bunches" of bubbles were noted—small bubbles rose individually and continuously from the surface almost as soon as the caustic soda was put on. The size of the drop and its shape incurred some variation, so about six readings per panel were averaged.

The experiments were repeated with 20 per cent HF (20 per cent v/v of the 40 per cent w/w acid in water).

It is obvious that the concentration of the corroding medium should be such that breakdown occurs fairly rapidly, without much relative dilution of the acid or alkali with aluminium compounds. In addition, the dye absorption test, as described in B.S.1615:1958, Appendix F, was carried out on the same panels.

The differences between panels sealed for various times by the various methods were not particularly noticeable on the drop tests, although usually breakdown occurred quicker on a 5 min. sealed panel than on a 30 min. sealed panel. However, the differences are not considered to be substantial enough to record results on individual sealing times, and hence the figures have been collected together for all the times and averaged. They are recorded in Table II, and a "P" or "F" indicates a "pass" or "fail" on the dye absorption test. These letters refer to panels from which any surface sealing bloom was removed prior to the application of dyestuff.

Used carefully, the dye absorption test would distinguish between a 5 min. or 10 min. sealed panel and a 30 min. one. It can be seen that the tests are agreed upon a "good" seal, i.e. distilled water, *p*H 5·6, 100°C., and disclose a bad seal, i.e. distilled water, *p*H 4·0,

TABLE I—WEIGHT CHANGE AFTER RESEALING

Time of Original Sealing	Type of Original Sealing Method							
Method (min.)	Distilled	100°C.	Distilled	80°C.	MWB	100°C.	*p*H 4·0	100°C.
2	−2·8	+6·5	+3·2	−6·1	+4·4	+5·6	+15·1	+6·0
5	+0·3	−0·3	−3·8	−5·9	+2·8	+8·3	+14·0	+1·8
10	0	−4	−1·6	−8·0	+0·1	+2·8	+11·9	+2·2
20	−6·3	−16	−2·8	−9·3	−0·5	+2·1	+11·6	−3·0
30	−7·4	+22	−0·3	−6·2	+0·2	0	+8·5	+1·4

TABLE II—DIFFERENCES BETWEEN SEALING TREATMENTS

Method of Sealing	Average Time of Breakdown in 10 per cent N a O H (sec.)	Order of Merit of Sealing Methods	Average Time to Breakdown in 20 per cent HF (sec.)	Order of Merit of Sealing Methods	Pass (P) or Fail (F) on B.S.1615 Dye Absorption Test
None	145	7	99	9	Badly F
Distilled 100°C. + Steam 100°C. 30 min.	249	2	188	3	P
MWB 100°C.	186	5	134	6	F
MWB 100°C. + Steam 100°C. 30 min.	189	4	186	5=	Just F
Distilled 80°C.	139	8	186	5=	Just P
Distilled *p*H 4·0 100°C.	131	9	104	8	F
Distilled *p*H 4·0 100°C. + Steam	154	6	124	7	F
Distilled 100°C. (1)	248	3	278	1	P
Distilled 100°C. (2)	367	1	227	2	P

100°C. The other two seals tested seem about equivalent. The results indicate that resealing in steam does not seem greatly to improve matters for panels which have already been "incorrectly" sealed, and in this respect support the weight tests recorded earlier.

Solution—Sulphur Dioxide Test

In contrast to test methods employing dilute moist gaseous sulphur dioxide, it was considered at the inception of the experiments that a solution releasing sulphurous acid should rather be employed, so that there would be no limit to the size of components which could be easily tested *in situ*, effectively non-destructively, since reject work could be easily stripped after the test if necessary.

It was necessary that a suitable test solution should retain SO_2 in solution long enough for it to attack any incorrectly sealed anodized surface and cause a reject to be easily discernible. A solution generating sulphur dioxide, i.e.

$Na_2SO_3 + H_2SO_4 \rightarrow Na_2SO_4 + SO_2 + H_2O$

was found to be unsuitable, as the sulphur dioxide was displaced from the solution too rapidly. However, certain organic acids, which give a *p*H of even around 2 in concentrated aqueous solutions, were found to be suitable. Such acids were acetic, tartaric and citric acid. The former is preferred as it is a liquid, easily and cheaply obtainable, and SO_2 is to some extent soluble in it.

Early solutions used with success were: Na_2SO_3, 10 gm/L, plus glacial acetic acid to *p*H 3, or tartaric acid crystals to *p*H 3 at 90-98°C., 30 min.

More positive results were obtained if sulphuric acid was added to *p*H 2·5. Finally, the following test solution was used: 5-10 gm/L Na_2SO_3, plus glacial acetic acid to *p*H 3·75 (approximately 50 mL for 10 gm/L Na_2SO_3), plus 5*N* sulphuric acid to *p*H 2·5 (approximately 15 mL for 10 gm/L Na_2SO_3), 30 min., 95°C.

Sodium sulphite (anhydrous) in excess of 10 gm/L did not seem to affect the test results, but the odour of SO_2 became very pronounced. The sulphite content of the solution may be controlled analytically by the volumetric iodine method,[13] but if the solution is being worked on a small scale it is often cheaper and quicker to discard the solution and make up a fresh bath.

Normally, a 10 gm/L bath is workable for two batches of components.

Standard sealing methods. Four different alloys were processed during about 20 test runs. They were super pure aluminium, B.A. SP.12 (British Aluminium Co. Ltd., 1½ per cent magnesium + super-pure aluminium-base alloy), H10W (magnesium silicide alloy), 1C (99 per cent aluminium).

They were anodized in 15 per cent w/w H_2SO_4, 20°C., 12 amp/ft², for various times, and sealed in one of the test solutions indicated below (both pre-etched and pre-chemically polished specimens were used).

(1) Boiling distilled water (from various suppliers), *p*H 5·6, 100°C., various sealing times.

(2) Boiling mains water, *p*H 5·6, 100°C. (a) Metropolitan Water Board (M.W.B.); (b) Birmingham Corporation Water Supply; (c) Marlow Water Co.

(3) Boiling distilled water + 0·5 per cent nickel acetate and acetic acid to *p*H 5·6, 100°C., 5 min., followed by 15 min. of either (1) or (2).

(4) Boiling M.W.B. water + 0·5 per cent nickel acetate and acetic acid to *p*H 5·6, 100°C., 5 min., followed by 15 min. of either (1) or (2).

(5) Distilled water, 80°C., *p*H 5·6, 20 min.

(6) Distilled water, 100°C., *p*H 4·0 with sulphuric acid.

(7) Steam 100°C.

After sealing, and "clearing" any sealing bloom in nitric acid, the test pieces were immersed for 30 min. in the test solution at 95° ± 2°C. They were then rinsed in cold running water and dried.

Failures were easily picked out by a heavy or moderate, even or patchy, white bloom covering the anodized surface. The depth of bloom varied with the degree and type of sealing; for example, a panel sealed by method (1) only had a very light surface bloom, whereas a panel sealed according to (5) had a heavy white bloom. With experience, bad failures could be detected after a few minutes in the SO_2 solution.

Failures were consistently noted in all cases of (2); (3)+(2); (4)+(1); (4)+(2); (5); and (6). The degree of failure varied from time to time with the M.W.B. and other supplies, i.e. panels having a light bloom to heavy bloom were obtained.

The degree of failure (i.e. the amount of bloom) varied for each sealing treatment, but consistently very bad bloom was obtained from methods (5), (6) and (2c). Mains water used at low temperatures caused worse failures than distilled water at a similar temperature.

The test can be used quantitatively by weighing samples before and after. The weight loss is proportional to the amount of bloom—a panel with heavy bloom may lose as much as 0·2 gm/24 in², whereas a panel with light bloom only loses 0·04 gm/24 in².

Use of the SO_2 solution test in a variety of sealing conditions. The fact that *p*H 4·0, 100°C. distilled water fails the test when the *p*H is obtained by addition of a drop or two of sulphuric acid is conclusive. Other acids, however, added to *p*H 4·0 did not cause a similar failure, whilst some caused even worse failures. Oxalic, malonic and phosphoric acids at *p*H 4·0 caused a very bad bloom to become apparent, while hydrochloric, nitric, chromic, and acetic acids at *p*H 4·0 passed the test quite satisfactorily.

The first three have, of course, been used as anodizing electrolytes, and are solvents for the anodic film, whilst the others, although not being anodizing electrolytes, have a degree of solution for Al_2O_3—particularly hydrochloric acid. The reason that chromic acid passes the test is, perhaps, due to the fact that chromate is absorbed or combined with the film to give a film containing absorbed chromate ion (*cf.* chromate sealing) or to form basic aluminium chromates which are very resistant to corrosive attack.

The reason that the presence of hydrochloric acid in a sealing solution does not fail the test is not clear (particularly as accepted practice is that water used for sealing should be substantially chloride-free), but it may be that chloride penetrates right through the film (being a small ion), attacks the base metal, and the $AlCl_3$ formed is hydrolyzed *in situ*.

A considerable number of experiments were carried out in order to ascertain the cause of failure of supply waters when used as sealing solutions. The hardness (permanent and temporary) of M.W.B. supply water was determined by standard methods, and equivalent quantities of Ca^{++}, Mg^{++}, Cl^-, SO_4^{--} and HCO_3^- added both together and individually to high grade distilled water to form sealing solutions. The *p*H of such made-up sealing baths was adjusted where necessary to *p*H 5·6 with dilute acetic acid, and the baths were used at 100°C. In each test run panels were anodized at 12 amp/ft² for 20 min. or 30 min. in the 15 per cent w/w H_2SO_4 bath, and sealed for similar times in the various solutions. Panels in each test run were also sealed in distilled water at *p*H 4·0 (to give a standard failure) and distilled water at 100°C. *p*H 5·6 (to give a standard pass). The following chemicals were tested as additives in this manner (a constant batch of distilled water being used for all the solutions):—

$CaCl_2.6H_2O$; $MgCl_2.6H_2O$; NaCl; Na_2SO_4; $CaSO_4$; $CaSO_4(Ca(OH)_2+H_2SO_4)$; $MgSO_4.7H_2O$; $NaHCO_3$; NaOCl; NaF.

Besides concentrations of these materials being added singly, and together in quantities equivalent to those in hard water (usually between 0·1 and 0·5 gm/L), higher concentrations were tried in some cases (1 gm. and 10 gm/L). The only bad failure was with 0·1 gm/L NaF, where a very patchy streaky bloom was obtained after the SO_2 solution test. Light to moderate bloom was obtained with Ca^{++} and/or Mg^{++} present (as $MgSO_4+CaCl_2$). Only slight bloom was noted with NaCl, NaOCl and $NaHCO_3$.

Whatever combination of components in the supply water is causing failure of sealed panels on the SO_2 solution test, it was found that their damaging properties could be reduced by dilution of a given volume of supply water with quantities of distilled water. 1 litre of sealing bath made up from 750 c.c. supply water and 250 c.c. distilled water failed the test badly, but with the constituent quantities reversed only a very slight failure was observed. Distillation or complete deionization provided the only sure methods of securing a suitable sealing bath from mains supply.

The presence of heavy metals in water was found to be a contributory factor—in particular, copper. Sealing baths were made up as follows, using high-grade distilled water.—

(1) 0·1 gm/L $CuSO_4.5H_2O$*; (2) 0·05 gm/L $CuSO_4.5H_2O$*; (3) 0·01 gm/L $CuSO_4.5H_2O$; (4) 0·1 gm/L $Fe(NO_3)_3.9H_2O$; (5) 0·05 gm/L $Fe(NO_3)_3.9H_2O$; (6) 0·1 gm/L $CuSO_4.5H_2O$+0·1 gm/L $NaNO_3$*; (7) 0·1 gm/L $Cu(NO_3)_2.3H_2O$; (8) 0·1 gm/L $Cu(NO_3)_2.3H_2O$+0·1 gm/L Na_2SO_4*; (9) 0·1 gm/L $Fe(NO)_3.9H_2O$+0·1 gm/L Na_2SO_4; (10) 0·1 gm/L $Pb(NO_3)_2$.

(Those marked * gave a heavy sealing bloom.)

Panels of D.57S were anodized at 12 amp/ft², 15 per cent w/w H_2SO_4, 20°C., 20 min., and sealed in solutions 1-10.

Distinct failures (heavy bloom) occurred in (1), (2). (6) and (8). The system $Cu^{++}+SO_4^{--}$ is, therefore, suspect.

These failures could not be correlated with those of mains waters, as no Cu^{++} or Fe^{+++} could be detected in mains supply with sodium diethyldithiocarbamate. An analysis of M.W.B. water supplied by the water board revealed no peculiarities, nor were any substances other than Cu^{++} or Mg^{++} in such concentrations as to be regarded as contributary factors.

It is to be concluded that Ca^{++}, Mg^{++}, with Cl^-, SO_4^{--} and HCO_3^- are contributary to failure of components sealed in supply waters. Failures were obtained when these ions were present in the water, but not equivalent to a failure caused by Birmingham or Marlow Water Co. supply, and only equivalent to M.W.B. failures tested at certain times.

It is apparent, therefore, that in order to produce water to pass an SO_2 solution test or any other SO_2 test, and therefore to give a really good seal, in the accepted sense of the word, it is necessary either to distill the water, or to remove all cations and anions from it by suitable ion-exchange process.

Resealing

The sulphur dioxide solution test was used to examine 0·0005 in. anodized panels of D57S which had been sealed in *p*H 4·0, 100°C. water, and resealed in steam at 100°C. or distilled water 100°C. Further batches of panels were first sealed in distilled water, 100°C., *p*H 5·6, then resealed in *p*H 4·0 water at 100°C.

It was found that re-sealing only exercised a marked improvement when distilled water was used. Steam was ineffectual. Re-sealing in *p*H 4·0 water had little effect. These results show that the sealing treatment first used determines the actual chemical state of the material—in other words re-sealing for normal periods of time can only go part of the way to reclaiming badly sealed work. Reclamation of moderately sealed work, i.e., initially sealed in some mains water supplies, may be more effectual.

Dyed Coatings

Dyed coatings were satisfactorily used with the SO_2 solution test. Some dyes leached badly (even if correctly sealed)—particularly red colours. In these cases it would be necessary to produce arbitary standards of pass and fail, prior to the use of the test as a method of acceptance or rejection of anodized work.

Conclusions

The use of steam at 100°C., or preferably boiling distilled or deionized water at 100°C., *p*H 5·5 to 6·0 have been shown to be the two best methods of sealing anodized aluminium. The effectiveness of supply water sealing depends on the geography of the supply, some waters giving a poorer seal than others. The calcium and magnesium salts present in these supplies are considered to be a contributary factor, and copper sulphate and fluoride present in as little as 20 p.p.m. exercise an appreciable retarding effect on the production of correctly sealed work. Sealing in acidic waters (*p*H 4·0) is bad practice with some acids present (notably sulphuric and oxalic) other acids have little effect.

This work illustrates that steam sealing is a different mechanism to deionized water sealing and it is considered that the latter is a better method than the former. Re-sealing in deionized water may be a method of reclamation of moderately sealed work, but the first sealing treatment determines to a great extent the properties of the anodic coating. Re-sealing in steam is not advocated.

A sulphur dioxide solution test is recommended as a rapid test method for elucidating sealing efficiency, and standards of acceptance and rejection may be laid down by the preparation of samples. In general, failures given by boiling Metropolitan Water Board supply were not as bad as those from acidic water, or sealing in low temperature water. The test may be used qualitatively (light bloom—good seal to heavy bloom—bad seal) or quantitatively (large weight loss—bad seal, small weight loss—good seal). It is considered that the sulphur dioxide solution provides both a useful workshop method and also an accurate laboratory tool for testing the quality of sealed anodic coatings, taking as little as one-hundredth of the time of the conventional SO_2 humidity test,

(*Continued on page* 122)

Machining Forging Dies

DEVELOPMENTS in spark-machining, once considered a useful method for working hard-to-machine materials, or the difficult-to-get-at operation, have now reached the stage where this process is becoming accepted as a metal-working technique of much wider production possibilities.

While electrode manufacture may still be a factor holding back a more widespread adoption of the process by the metal-working industry generally, the indications are that the forgings industry is very much alive to its future possibilities.

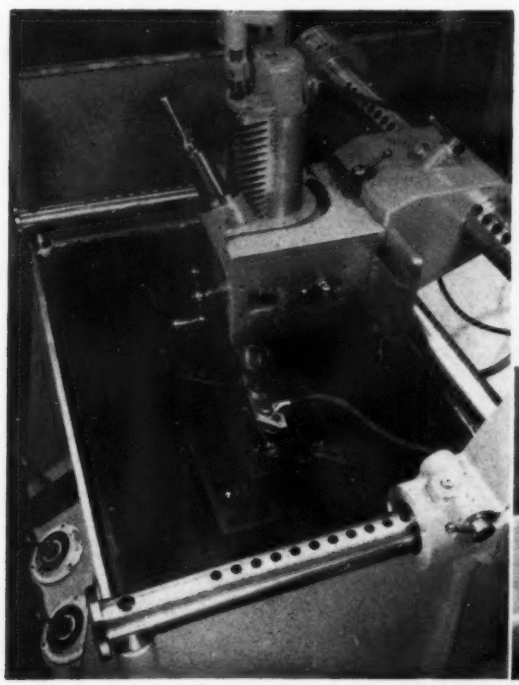
One of the most recent introductions in this field is a further model in the Wickman range of Erodomatic machines. Designed particularly for the machining of forging die blocks up to 28 in. × 16 in. × 15 in. deep, the new machine, for which patent application has been made, incorporates automatic controls completely obviating manual attention during operation and can operate at very fast metal-removal rates. The inherent self-feeding characteristics of the spark-machining process have been employed to produce a machine which, once set-up, will continue erosion throughout any die-sinking operation completely unattended, and thus reduce the labour content to very small proportions.

The equipment is designed as three units; the machine tool, generator and dielectric fluid circulator, each being capable of disposition according to the shop layout. The units are of uniform width and particularly suitable for in-line arrangement.

Among the features of the machine is the arrangement of the servo head unit which can rapidly be moved to its furthermost backward position to clear, and give unimpeded access to, the work tank area. The transverse cross rail carriage and the servo head unit can be precisely located in 1 in. increments, and fine adjustments in increments of 0·001 in. on both rectangular co-ordinates of the servo head are provided. Fitting and inspection of electrodes are facilitated by the upward pivotal movement of the servo head.

The control panel carries: "on"-"off" push buttons, a 3-position cutting range selector, a lever operating the "Worktank Fill" cock, a 2-position quill for "Fast Up" and "Fast Down", a servo adjustment control, and an amber light indicating "Mains On".

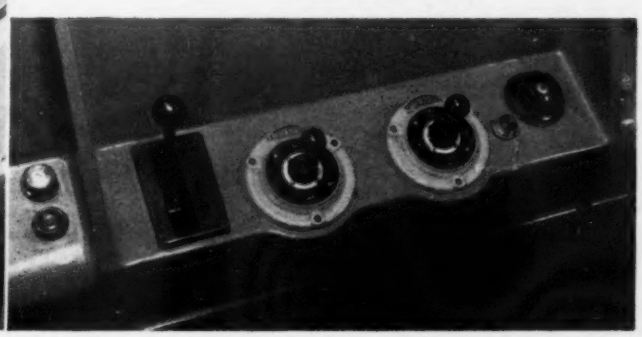
Two models of the machine are available, the Erodomatic W/DM (4·5) and W/DM (13·0), each with three cutting ranges, providing metal removal rates of 100, 150, 300, 400 and 1,000 mm³/min.



Above: The tool head of the Wickman Erodomatic may be pivoted upwards to facilitate inspection and the fitting of electrodes

Left: The tool head carrier showing coverage provided by adjustment along transverse and longitudinal rails

Below: The control panel



SUMMARY OF PROCEEDINGS AT BIRMINGHAM UNIVERSITY CONFERENCE

Electric Arc Welding

IT has been the practice in the past two years at the University of Birmingham to hold a one-day conference on an aspect of welding or brazing which is being investigated by the joining of metals research team. A third conference was held this year on June 25 under the chairmanship of **Professor E. C. Rollason,** head of the Department of Industrial Metallurgy, and the subject on this occasion was the role of "The Electric Arc in Welding." About one hundred representatives of industry, the research associations and the universities attended to hear five Papers, on arc-metal interactions, the mechanism of metal transfer, and the new development of the constricted arc.

Arc-Metal Interactions

The conference was opened by Professor Rollason, who pointed out that despite the effort which had been expended over a period of some fifty years to bring modern arc welding processes to the present state of satisfactory development, very little was known of the underlying fundamental principles. To some extent the basic problems have not been clearly defined and Professor Rollason suggested that, in addition to the initiation and maintenance of a stable arc, which is the subject of investigations by Orton and Needham, of the Electrical Research Association, there are three specific arc-metal interactions of significance in welding. First, there is heat transfer from the arc, which is responsible for the formation of the weld pool; secondly, there are the chemico-metallurgical reactions taking place between the high temperature gases in the arc atmosphere and the weld metal, resulting in porosity and embrittlement; and thirdly, there is the transfer of metal droplets across the arc, which can take place against gravity and for which no satisfactory mechanism has yet been advanced.

The present state of knowledge of those aspects of arc physics which appear to have a bearing on these problems was then surveyed by **Mr. D. R. Milner,** of the Department of Industrial Metallurgy. Throughout the main body of the arc, electrical energy is utilized to heat the gas to such a temperature that it becomes thermally ionized, and is thus able to provide the ions and electrons necessary to carry the required current. The temperatures attained in welding arcs lie between 5,000°C. for metal vapour arcs and 30,000°C. for the core of the argon arc. At these temperatures, all molecular gases are dissociated into atoms and are, therefore, highly reactive. Thus, the basic problem in the study of chemical reaction occurring between the molten weld metal and the high temperature arc atmosphere is the transfer of cold gas from the surrounding atmosphere into the arc, where it attains a high temperature, and its subsequent movement to the molten metal surface, where it can react to form a compound or go into solution. Some of the factors which must be significant in this process are the amount of energy dissipated in the arc column, the properties of the gas, and the flow pattern of the gas in the vicinity of the arc. In relation to the latter, some work which was done on the fundamentals of arc physics by H. Maecker at the Siemens laboratories would appear to be very significant. Maecker showed that, wherever there is a constriction in an arc, as occurs naturally, for example, at the cathode spot of a tungsten cathode in argon arc welding, there is a region of higher gas pressure, and that gas flows from this high pressure region along the arc to a region of lower pressure. The arc thus acts as a pump, sucking in cold gas and heating it up in the arc column to form a high temperature plasma jet with a velocity of 10^4 to 10^5 cm/sec.

In the same way that cold gas can be heated in the arc column and then react chemically, so a certain amount of heat can be transferred to the electrodes by non-reacting gases which have been heated in the arc column. However, this is probably only a minor effect, since the high energy electron stream flowing into the anode, and the positive ion stream entering the cathode, are principally responsible for the melting of the electrode and the formation of the weld pool. For low current arcs the anode processes are well established, but less is known of conditions at the cathode. Very little information is available in either case which relates to high current welding systems.

Chemical Reaction

A Paper contributed by **Dr. G. R. Salter,** of the Department of Industrial Metallurgy, described the results of an investigation of the absorption of oxygen by titanium melted by an electric arc in an atmosphere of argon containing controlled amounts of oxygen. The effects of time, oxygen partial pressure, arc length, current, electrode composition and gas flow conditions were described, and it was shown that the factor which determined the amount of oxygen absorbed by the titanium was the rate of supply of oxygen to the metal surface. It was concluded that the supply of oxygen to the vicinity of the metal surface was readily maintained on account of the high velocity of the gas in the arc, and that the limiting barrier to the reaction was a "stagnant" layer of gas which existed adjacent to the metal surface and across which the oxygen had to diffuse. It was also found that intense chemical reactivity was limited to a high temperature active area, the size of which increased with the current and arc length. The thickness of the boundary layer, of the order of 10^{-3} cm., was not determined, as at first sight might be expected, by the velocity of the shrouding gas flowing through the argon-arc torch, but by plasma jets in the arc of the type described by Maecker. By applying the non-dimensional analysis developed by chemical engineers for this type of reaction, it was possible to obtain a formula which should describe to a fair approximation the amount of gas available for reaction with a metal in any non-consumable electrode gas-metal combination.

Heat Transfer

An account was given by **Mr. J. B. Wilkinson,** also of the Department of Industrial Metallurgy, of an investigation of heat transfer in arcs, which was designed to examine the energy dissipation in arcs generally and to consider in particular the heat transfer from the hot arc plasma gases to the electrodes. Wilkinson had determined energy balances for arcs operating between a tungsten cathode and a water-cooled copper anode in atmospheres of argon, nitrogen, helium and hydrogen, and also examined the effect of replacing the copper anode by titanium, molybdenum and nickel. This work provided a set of basic data, the interpretation of which would require an understanding of arcs far in excess of that at present available, and so only those aspects which were considered to be of particular importance in welding, i.e. the conversion of electrical energy for heating the arc column and subsequent heat transfer to the electrodes, were investigated in more detail. The existence of plasma jets originating at the tungsten cathode and impinging on the anode was demonstrated, and their velocities estimated. Further experiments were then described in which the heat transfer from the plasma jet had been separated from that due to the electron heating of the anode. The results were interpreted in terms of a similar model to that proposed by Salter for mass transfer, i.e. with convection transferring the heat to a boundary layer of gas adjacent to the metal surface.

Metal Transfer

During the course of the work on heat and mass transfer, which has been described above, the importance of plasma jets became very evident. It

was then realized that, in addition to their role in heat and mass transfer, these jets could provide the means by which metal is transferred across the arc, a problem which has been the object of many investigations in the past. A research was, therefore, started at Birmingham University to look into this possibility, and the first results were very encouraging. It was then found that metal transfer was also being investigated at the Electrical Research Association with the same underlying mechanism in mind. Since a subsequent meeting showed the two researches to be complementary in their approach to the subject, efforts were then combined in a joint investigation, which was presented at the conference by **Mr. J. C. Needham,** of the E.R.A. The basis of the work at E.R.A. was the examination of the detachment and flight of the droplets by super slow motion colour photography (8,000 frames/sec.). The existence of a plasma jet could be clearly seen from a stream of vapour from the droplets which, although it was emanating from all round the globules, flowed only in the direction of the plasma jet. Supporting evidence for the hypothesis that the plasma jet provides the force acting on the globules was forthcoming from the fact that measurements made from the photographs showed clearly that the velocity of the drops continued to increase with accelerations of 10 g to 100 g after they had become detached and were in free flight through the arc, attaining terminal velocities in excess of 500 cm/sec. Experimental determinations of the droplet velocity as a function of current, derived from the photographs taken by Needham, and from trajectory determinations by Mr. C. J. Cooksey, of the University of Birmingham, compared well with theoretical calculations based on a model in which the drop became detached when the force exerted on it by the plasma jet exceeded the restraining force of surface tensions, and was then freely accelerated across the arc by the impinging gas stream.

The Constricted Arc

The final Paper, by **Mr. A. R. Moss,** of the Ministry of Supply, dealt with a development of the electric arc which is finding recent commercial application, that is, the constricted arc. It is an interesting characteristic of the electric arc that the more intensely it is cooled, the higher the core temperature becomes. This is because if the arc is cooled, as, for example, by burning it through a narrow water-cooled copper tube, then the area which is available to conduct the current is smaller and must, therefore, become more conducting, that is, the density of charge carriers, and, therefore, the temperature, must increase. Spectroscopists and arc physicists have used this property of the arc for some years to heat gas to temperatures up to 50,000° C. Moss elaborated on this property of the arc and showed how it could be harnessed to technological advantage. He described the various types of plasma jet projectors and constricted arc torches developed in the Armament Research and Development Establishment. Although the design and characteristics of devices of up to 100 kVA, using consumable and non-consumable electrodes, were emphasized, much larger ones were mentioned. Their many present and potential applications include:—chemical synthesis; the purification of high melting point materials; the determination of the resistance of materials to thermal shock; and the melting, welding, cutting, spraying and surface hardening of metallic and non-metallic materials. The fact that these operations may be conducted in non-contaminating atmospheres indicated the considerable industrial potential of these new devices.

PROSPECT FOR WIDER APPLICATION OF COPPER-NICKEL-ZINC POWDERS

Nickel Silver Sinterings

POWDER metallurgy provides a simple and economical means of producing small parts to close tolerances, and sinterings pressed from a great variety of metal powders operate successfully in functional applications ranging from precision mechanisms to farm machinery. Almost all such applications are strictly utilitarian and most sinterings go into service with their natural finish. Only a minority of powder metallurgy products is given any sort of applied finish before use.

To a large extent, this results from the design limitations applying to sintered components; because of the very small degree to which lateral flow of the metal powder can occur under pressure, sinterings tend to be angular in character. If of any complexity of form they must usually be, in effect, built up of superposed laminar elements as in Fig. 1. This is because each surface of a sintering is normally formed by an independently-acting punch. Since, until very recently, the trend of industrial design has been toward smoothly-faired contours, these design restrictions have worked against the adoption of powder metallurgy parts for decorative trim or as exposed functional elements for which "eye-appeal" is a desideratum.

Most such articles, accordingly, have in the past been produced as sheet-metal pressings or as die-castings, thus permitting the adoption of rounded or "streamlined" shapes and, of equal importance, allowing a choice from a wide variety of applied finishes. There are, however, indications that contemporary styling—at least insofar as the design of durable consumer goods is concerned—is beginning to turn away from smooth contours toward a new hardness of line: the uncompromising planarity of sinterings accords well with this new outlook and a wider use of powder metallurgy for exposed functional parts, of not too large a size, is a likely development.

Finishes for Metal Powder Parts

The application of colourful organic finishes to sinterings presents no difficulty, whilst vacuum metallizing offers a means of producing a lustrous metallic coating on parts which, intrinsically, are rather dull and unattractive in texture. Electroplating is perhaps less suitable as a general commercial finish, for although electrodeposition is practicable for almost all metal powder parts, and appropriate plating techniques have been developed, it is not always practicable to produce intricate components with the high density and homogeneity that are necessary to prevent plating fluids from percolating the structure and setting up corrosion cells.

Special interest, therefore, attaches to those metal powders which produce sinterings that can be given a permanent lustrous finish, fully comparable with an electroplated coating, by merely buffing the natural surface. For most applications it is, of course, additionally necessary that the com-

TABLE I—PROPERTIES OF NICKEL SILVER SINTERINGS

Composition (per cent)	Density (gm/cc)	U.T.S. lb/in²	Elongation (per cent on 2 in.)	Hardness Rockwell	Yield Strength in compression (0·1 per cent set) (lb/in²)
Copper 64 Nickel 18 Zinc 18	7·3-7·8	20,000-35,000	6-10	H40-H90	~18,000

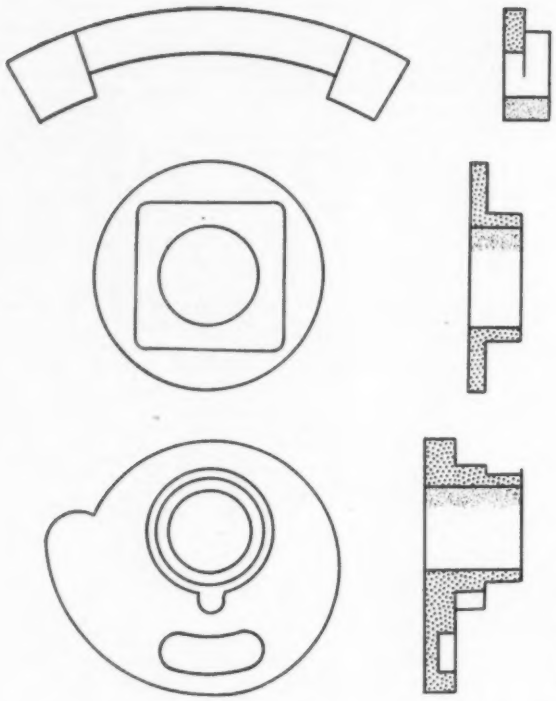


Fig. 1—Three typical powder metallurgy parts; although differing in complexity, all are built up from simple laminar elements of constant thickness

ponents shall have relatively high impact strength, and these requirements are best met by one of the "nickel silver" powders — copper-nickel-zinc of which several different compositions have been developed by the New Jersey Zinc Company and other producers of metal powders. Mechanical properties for the various specifications differ among themselves but, as a group, are superior to those of the standard brass powders. They are tough and, by virtue of their nickel content, are notably resistant to corrosion.

For the production of small, semi-decorative parts, they have the great advantage of taking a high-quality finish without requiring an elaborate processing sequence. Many "nickel silver" sinterings are put into service with a satin finish obtained by barrel-burnishing, usually with a soap solution. Balls, or steel "shapes," may be added to the work being tumbled should this prove necessary, but many sintered parts are so simple in shape as to be self-tumbling. After a hot rinse and drying in air or sawdust the burnished components are ready for service.

Components which for any reason do not lend themselves to barrelling treatments may be given an equivalent finish by scratch-brushing; sometimes, too, this operation follows a "cutting-down" barrelling period during which the raw edges of the component are slightly radiused. Buffing on a wheel produces an attractive high lustre, resistant to tarnish and resembling a good-quality silver plate.

Sealing Anodized Aluminium—*continued from page* 118

needing no elaborate plant, and with no limitations on the size of components which can be tested. The results agree with those given by the SO_2 humidity tests, and existing dye absorption and caustic soda drop tests.

The author wishes to thank Mr. K. W. Mathieson, general manager of Alumilite and Alzak Ltd., for permission to publish this article.

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Men and Metals

A partner in Trent Laboratories, metallurgical consultants, of Stoke-on-Trent, **Mr. B. M. Hardman,** has, after examination, been elected a Fellow of the Institution of Metallurgists.

A reorganization of the Development branch of the Mond Nickel Company's Development and Research Department has resulted in the formation of four divisions under the general managership of **Mr. F. Dickinson,** a director of the company. In this connection the following appointments have been announced: **Mr. W. W. Braidwood** to be manager of the ferrous division; **Mr. J. Hinde** to be manager of the non-ferrous division; **Dr. A. B. Everest** to be manager of the applicational engineering division; and **Dr. E. C. Rhodes** to be manager of the general division, including plating, chemical products and nuclear power. **Mr. L. W. Johnson,** at present assistant manager of the department, having reached retirement age, will relinquish his appointment at the end of this month.

Directors of the Wolverhampton Metal Company Limited, **Mr. F. W. James** and **Mr. K. R. H. James** have been appointed assistant managing directors of the company.

Cold Extrusion

WITH a 60° cone-angle on the head of the billet and a 60° conical die-entry, the pressure needed to extrude copper rod is 28 per cent less than that required to extrude a normal cylindrical billet through the same die. This technique is likely to be particularly useful in the production of extruded products which are normally outside the capacity of a press.

The work, described in M.E.R.L. Plasticity Report No. 138, is being carried out to see in what ways the varying ram speed of a crank press affects the extruded product, in comparison with extrusion in a hydraulic press where the ram speed is constant throughout its stroke.

The pressures required to produce a given reduction in aluminium, copper and brass were found to be similar to those needed in a hydraulic press at slower speeds. The extrusion pressure was related linearly to the logarithm of the extrusion ratio (the ratio of cross-sectional area of the billet to that of the product) for aluminium, copper, brass, niobium, titanium, and a range of steels.

Successful extrusions were carried out at large reductions from unheated billets—in most cases the limit of reduction seems to be imposed by the maximum permissible stress in the punch.

New Plant & Equipment

Roller Levelling

A ROLLER levelling machine of the 17-roll type with triple banks of back-up rolls fitted to the upper and lower banks of work rolls has been introduced by The Bronx Engineering Company, Ltd., Lye, Nr. Stourbridge. The machine will take sheet up to 6 ft. wide and 10 gauge.

The rolls are of carbon chrome steel 2¼ in. in diameter, hardened to 85/90 Scleroscope and the top bank of rolls is arranged to tilt. The back-up rolls rest in the work rolls and the roll necks run in needle bearings.

Adjustment is provided to the back-up rolls on the lower work rolls, enabling pressure to be directed to the sheet where required. The back-up rolls are of carbon chrome steel of 78/80 Scleroscope so that they will not mark the work rolls. Indicators are provided to show the roll position, and mechanical lubrication is provided for all working bearings.

The gear box is of fabricated steel construction, all gears and bearings being self-lubricating.

The machine is operated by a 35 h.p. slip ring motor complete with reversing starter to give a levelling speed of approximately 40 ft/min. At the inlet side of the machine a pair of heavy driven pinch rolls are fitted for feeding strip from the coil.

Sub-Zero Treatment

CONTROLLED temperature conditions are becoming more and more important in engineering works as well as research organizations, and interest has grown in sub-zero cabinets whose temperatures can be pulled down quickly and held accurately for long or short periods.

Four standard models are made by Lec Refrigeration Ltd., of Bognor Regis, Sussex. These are: CL.15, with a temperature range from ambient to −73°C. and a cubic capacity of 1·5; CL.30, ambient to −73°C., 3 ft³; CL.15H, +121°C. to −73°C., 1·5 ft³; CL.30H, +121°C. to −73°C., 3 ft³.

These cabinets are also made to any required specifications for any particular application. In one cabinet produced recently temperatures of −200°F. were reached.

Every Lec cabinet is available with optional extras, such as vacuum-sealed viewing windows, positive air circulation and instrumentation to meet any specialized requirements.

The refrigeration system comprises either single, double or treble staging of compressors, depending on the size and range of temperatures required, and charged with safe dependable refrigerants.

The controlled temperature environment cabinet has many uses, including ageing, shrink fitting, hardening and stress equalization of metals; research and testing of metals, plastics, rubber, lubricants, electrical equipment and instruments, etc., together with storage and preservation of chemicals, etc.

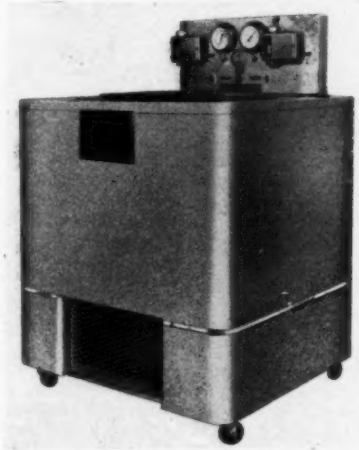
Tube Bending

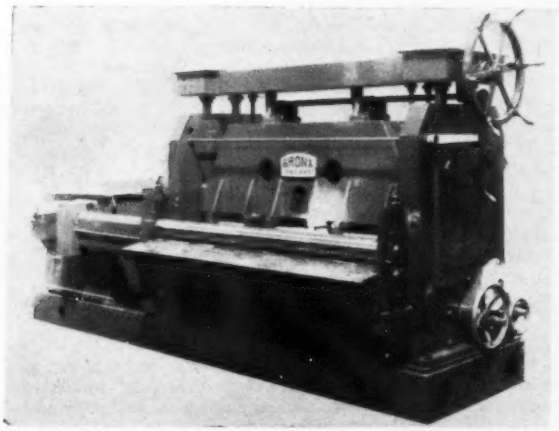
A SEMI-AUTOMATIC mandrel type tube bending machine which incorporates several new features has been added to the range made by Hilmor Ltd., Caxton Way, Stevenage, Herts. A mechanical drive has been chosen as the prime mover and the machine will produce on a repetition basis the comparatively simple bends required for tubular furniture, cycle handlebars, car exhaust pipes etc., and by the use of wiper dies and articulated mandrels it will also produce full bore tight radius bends in light gauge stainless steel, aluminium alloy, tungum, etc., tube.

The maximum capacity of the machine is 1½ in. bore × 16 G. non-ferrous tube (u.t.s. 32,000 lb/in²) and 1¼ in. o.d. × 14 G. steel tube (u.t.s. 60,000 lb/in²). The transmission is housed in a mild steel fabricated chassis. The 3 h.p. electric motor, incorporating a brake, is flange mounted to a spur gear change speed reduction box giving bending speeds of approximately 2½, 5, 10 and 18½ r.p.m., which in turn is directly coupled to a single reduction worm gearbox. A heavy bushed roller chain then transmits the power to the bending head. The bending head houses the automatic grip and pressure die clamping mechanism, both of which are designed for full and very fine adjustment. The entire transmission and bending head mechanism is immersed in oil.

Control is by foot-operated switch and a twelve station degree of bend selector, either automatic or manually controlled, is fitted. The machine is

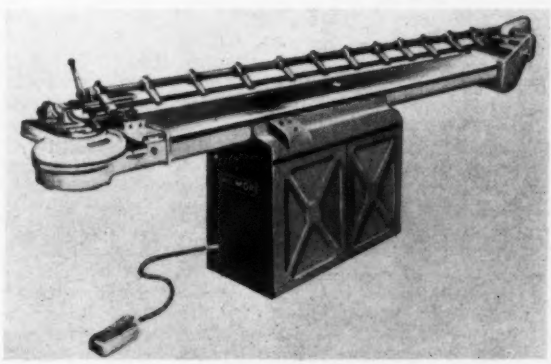
The Lec controlled temperature environment cabinet





Below right: The Hilmor mandrel-type tube-bending machine

Below left: The Bronx 17-roll levelling machine



The Olsen "Air-O-Brinell" hardness tester

capable of right and left hand bending and the changeover is effected easily and quickly.

Hardness Testing

ELIMINATING mechanical linkages, deadweights and hydraulics the principle of an air-operated Olsen "Air-O-Brinell" hardness testing machine is that accurately regulated air pressure is applied by means of a heavy duty, long stroke diaphragm to the moveable ram carrying a hardened steel ball which, in turn, applies the preselected Brinell load to the specimen.

Under normal operating conditions only 1·2 ft^3 of delivered air per minute at a minimum pressure of 65 lb/in^2 is required to operate the tester. Since the amount of air accumulated in the head of the machine is accurately controlled by an air regulation valve, fluctuations in the air supply above 65 lb/in^2 have no effect on the operation or accuracy of the machine.

Load application is positively assured by reason of the air gauge indicating the load which will be applied before the test is made. Simple adjustment of the air regulator valve increases or decreases the air pressure in the machine until the desired load is indicated on the gauge and once the load is set, any number of tests can be made in rapid sequence.

The gauge which is calibrated for the standard range of Brinell loads of 500, 1,000, 1,500, 2,000 and 3,000 kg., is being made under licence in this country by Edward G. Herbert, Atlas Works, Levenshulme, Manchester 19.

Reader's Digest

STRUCTURE OF METALS

"The Structure of Metals: A Modern Conception." *Published for the Institution of Metallurgists by Iliffe & Sons Ltd., Dorset House, Stamford Street, London, S.E.1. Pp. vi+118. Price 25s. 0d.*

PUBLICATION of the lectures delivered at the Refresher Course organized by the Institution of Metallurgists at Eastbourne in 1958 again does metallurgists generally a good service. These consist of four Papers: (1) "The Electron Structure of Metals," by G. V. Raynor, M.A., D.Sc., Feeney Professor of Physical Metallurgy in the University of Birmingham; (2) "Experimental Aspects of the Electron Theory of Metals," by J. A. Catterall, Ph.D., of the Metallurgy Division of the National Physical Laboratory, Teddington; (3) "Dislocations in Metals," by A. G. Quarrell, D.Sc., F.Inst.P., Professor of Metallurgy in the University of Sheffield, and (4) "Seeing Dislocations," by J. Nutting, M.A., B.Sc., Ph.D., of the Department of Metallurgy of the University of Cambridge.

Between them, these Papers trace the history of the idea of dislocations from its first conception some twenty-five years ago to its much more recent experimental proof. The four lectures are printed in the book in the order in which they were presented at Eastbourne, but it is a matter for debate as to whether this is necessarily the best order in which they should be read, at any rate by the ordinary "bulk metallurgist" who seeks to know something of what these dislocations are and what they can mean to him. To most such people, as well as to many of those who attended the course, the first appeal is that of experiment. Hence, a preferred order might have been (1) Nutting, (2) Catterall, (3) Quarrell, and (4) Raynor. It is not that this preferred order represents the merit of the Papers from the point of view of presentation, because they are all first class, as would be expected from such people. Professor Raynor, for instance (who has since been elected F.R.S., on which we all congratulate him heartily), started off with the simplest conceptions, but before long we had reached "spin quantum" numbers, and the depth of his discourse may be judged from this quotation from p. 23: "Since any bound state must be derived from an energy level which, in the pure unperturbed solvent, corresponds with a wave function continuous throughout the whole lump, the total number of energy levels in a band or set of overlapping bands is decreased every time a bound state is added by the perturbing effect of a solute atom; conversely, the disappearance of a bound state leads to an increase of one in the number of energy levels in the conduction band."

Equally impressive sentences could be quoted from the other authors. Professor Quarrell, for example, says (p. 82): "It is of interest that the ease of climb will depend upon the jog density." This use of "jog" and "climb,' familiar enough to metal physicists, constitutes another example of ordinary English words applied to the physics of the solid state with a special meaning; when your reviewer heard Professor Quarrell talk of "sessile dislocations" the impression was that this was a coined word specific to the phenomenon and only understood by the initiated, but it turns out to be an ordinary English word from the same root as "sedentary," and has been in use for over 200 years!

The book is an excellent manual for those who wish to bring themselves up-to-date with metal physics as it is now understood. It is, however, unfortunate that the plates accompanying Dr. Nutting's Paper do not correspond with the figure references in the text, although they appear to be in the right order. It is a pity also that the line drawings in Professor Raynor's Paper are so obviously freehand, especially Fig. 2, and less noticeably Fig. 5. It seems that on pages 6 and 8 the printer ran out of his stock of the letter "u." Finally, one must make the same point as in reviewing the corresponding volume of the 1956 Refresher Course lectures: that care should be taken to see that those lecturers who are members of the Institution should be credited accordingly, but only Professor Quarrell and Dr. Catterall are. Professor Raynor also deserves his "F.I.M.," especially as he is currently on the Council. **J. W. J.**

HOT DIP GALVANIZING

"Hot Dip Galvanizing 1958." *Published by Zinc Development Association, 34 Berkeley Square, London, W.1. Pp. 355. Price 60s. 0d.*

CONTAINING the edited proceedings of the Fifth International Conference on Hot Dip Galvanizing, this volume has been published by Z.D.A. for the European General Galvanizers Association.

The subjects covered include pickling and fluxing, bath heating, process efficiency, strip galvanizing, painting galvanized steel, wire galvanizing, influence of bath and steel composition, non-destructive tests, materials handling, and a survey of progress.

In addition to the Papers presented at the conference—there were 20—the discussions which followed are also included in this volume, and the book provides a useful record and reference to the current state of progress in the galvanizing industry. It is well illustrated and attractively presented; it lacks, however, an index—an omission that diminishes its value for reference purposes.

Industrial News *Home and Overseas*

A Midland Meeting

A Symposium has been arranged by the Midland branch of the **Institute of Metal Finishing,** to be held at the Imperial Hotel, Birmingham, on Tuesday, October 6 next, commencing at 2 p.m. The Symposium will report on, and discuss, technical proceedings during the International Conference on Electroplating and Metal Finishing, held in June last at Detroit, Mich., U.S.A.

The meeting will be divided into three sessions, each session being devoted to a series of Papers presented at Detroit. Reports will be made by speakers who were present at the conference. After each report a period will be available for questions and discussions.

A programme of this Symposium and full details of the various Papers to be reported upon may be obtained from the hon. secretary of the Midland branch of the Institute — Mr. I. T. Watkins, Westalite House, Bradford Street, Birmingham, 5.

Delivered by Tanker

Bulk deliveries of chemical polishing solutions are now being made to the Birmingham metal finishing firm of Haynes, Ford and Elliott Ltd., by **Albright and Wilson (Mfg.) Limited.** The first deliveries, made by a 6-ton tanker this month, will cut costs and make handling much easier. The Birmingham company has installed a 1,000-gal. storage tank to take supplies of Phosbrite 159.

Haynes, Ford and Elliott Ltd. operate a 600 gal. Phosbrite tank with a throughput of close on 5,000 ft² surface area per day, of which half is SP aluminium, or alloy of 99·8 per cent purity or better. A wide variety of items are chemically polished by this firm, from automobile bright work to domestic appliance trims and curtain rail.

Area Representative

A new sales representative for the Lancashire area has been appointed by Sheepbridge Equipment Limited (Foundry Division) and Sheepbridge Alloy Castings Ltd. Mr. E. J. Pearson, who will be resident at Langho, near Blackburn, will be responsible for promoting sales of the wide range of castings produced by these two companies.

Refresher Courses

It has been announced by the Education Committee of the **Institution of Plant Engineers** that the next of their comprehensive refresher courses for senior works and plant engineers is to be held this winter at Leeds University. Sponsored by the Pro-Chancellor of the University, this is the latest of a series of major courses at various centres in Britain, all of which have set up enrolment records for engineering refresher courses. It will comprise 18 weekly lectures on Thursday evenings, commencing October 29.

The syllabus covers an extensive range of subjects, treated by specialists drawn in the main from industry, and includes: The Pros and Cons of Systematic Control and Planning in the Engineering Department; The Value of New Materials and Techniques in the Solution of Engineering Problems; Some Current Techniques and Future Trends in the Planning of Plants and their Subsequent Operation; Cost Consciousness and the Engineer; The Impact of Automation on the Plant Engineer; Lubrication; Combustion and Steam Raising; Oil Firing; Steam Utilization; Space Heating; Thermal Insulation of Industrial Buildings; Electrical Systems in Factories; Materials Handling; Properties and Treatment of Metals and Alloys; Developments in Welding Practice; Industrial Accident Prevention; Management in Plant Engineering.

The fee for the Course is four guineas and copies of the syllabus and full particulars may be obtained from the Secretary to the Refresher Course, Department of Engineering, The University, Leeds, 2.

London Office

In order to give greater service to their customers, the London office of **Kayser Ellison and Co. Ltd.** has been moved to 4 Pembridge Mews, Notting Hill Gate, London, W.11, with the telephone number of Bayswater 9131-2.

Aluminium Buses

It is reported that London Transport has now in service a number of their new "Routemaster" buses, which are lightweight 64-seaters constructed throughout in light aluminium alloy. It is understood that this bus is lighter than the previous buses when fully loaded, although it actually carries eight more passengers. The bus is of chassisless design, with coil spring suspension on both front and rear axles.

Prices of Silver

A table showing the monthly fluctuations, in London, in the price of bar silver per ounce, from January 1833 to December 1958, has just been published by **Sharps, Pixley and Company,** the London bullion brokers. This table contains some interesting notes on events during the years covered. From 1833 to 1944 the prices quoted are per ounce, standard (0·925 fine) and thereafter at 0·999 fine per ounce. The average price per year is also given, as well as the figure for export of silver to the East, and the imports of silver.

Industrial Eye Protection

Details of their latest eye protection wear—"Starlight" protection wear—have been issued by **Randolph Optical Supply Co. Ltd.** These models have been tested under working conditions and have been found satisfactory. The company state that several large industrial concerns are using these regularly with success.

Bronze and Brass Founders

Meetings of the **Association of Bronze and Brass Founders** have been arranged as follows:—Yorkshire area on Monday, September 28, at the Northern Hotel, Leeds, at 12.15 p.m., and of the Scottish area at the St. Enoch Hotel, Glasgow, on Wednesday, September 30, at 12 noon. Following both meetings a lecture will be given on "Costing a Casting."

Showing in Paris

At the European Machine Tool Exhibition, now being held in Paris, a representative range of Triulzi "Castmatic" hot and cold chamber die-casting machines are being exhibited, we are told, by **Alexander Cardew Ltd.** Also being shown is the Triulzi 10-ton Arbor press, the oil-operated record press, and their automatic 30 gr. plastics machine.

The "Castmatic" range of Triulzi die-casting machines are being made in the United Kingdom by **Baker Perkins and Company Ltd.**

Metal Stocks

Stocks of refined tin in London Metal Exchange warehouses at the end of last week rose 708 tons to 8,537 tons, comprising London 4,949, Liverpool 3,428, and Hull 160 tons.

Copper stocks fell 300 tons to 14,663 tons, and comprised London 2,997, Liverpool 6,091, Birmingham 425, and Manchester 5,150 tons.

Malayan Tin Stocks

It is reported from Singapore that Malaya's stocks of tin metal at the end of July last amounted to 14,105 tons. This compares with 13,096 tons at the end of June.

New Copper Refinery

News from Tel Aviv is to the effect that plans for a joint Cypriot-Israeli enterprise establishing a copper refinery in Haifa to process copper pyrites imported from Cyprus are now being finalized. A new company — the Israel Ore Processing Company—is stated to have been formed for this purpose. Total investment is estimated at £4 million (Israeli).

It is also reported from business sources that the Israeli Government, which had approved blueprints for the plant, would loan the company £1·5 million (Israeli). Equipment for the plant would be bought from Britain and West Germany. Production would start in January 1961, with the plant processing initially 30,000 tons a year. Nearly half the output would be for export to Europe. It was added that, in addition to refining copper, the projected plant would also produce sulphuric acid.

Italian Copper

Italian imports of crude copper for smelting and refining in the first six months of 1959 were 2,120·7 metric tons, valued at 840,885,000 lire, according to the Central Statistical Office. Main suppliers were Rhodesia and Nyasaland, 506 tons; South Africa, 507·2 tons, Chile 713·5 tons; and the United States 393·8 tons.

Imports of refined copper in slabs, ingots, shot and powder were 53,474·8 metric tons, valued at 20,890,193,000 lire, of which 9,058 metric tons, valued at 3,617,230,000 lire were imported temporarily. Main suppliers were Britain, 5,171·7 tons; Belgium and Luxembourg, 1,512·5; Belgian Congo, 12,917; Rhodesia and Nyasaland, 7,411·3; South Africa, 2,165·5; Chile, 11,055·1; and the United States, 10,983·1 metric tons.

Zinc in U.S.A.

Slab zinc consumption in the United States in June 1959, as reported by about 500 companies, rose by 9 per cent to 94,500 tons, according to the Bureau of Mines, United States Department of the

Interior. Zinc used by galvanizers rose to 40,500 tons, about 1 per cent below the all-time record of 40,900 tons used by that industry in October 1956. Manufacturers of zinc-base alloys used over 7,000 tons more slab zinc in June than in May, bringing their total to 36,300 tons. Brass mills and ingot makers consumed 10,800 tons, compared with 12,000 tons in May.

Smelter stocks of slab zinc fell 26,600 tons to 169,400 tons, the lowest monthly level since January 1, 1958. Consumers' inventories, however, increased 10,400 tons to 86,800 tons on June 30, as receipts of slab at these plants reached 104,800 tons, surpassed only in March 1945, when a total of 110,000 tons was received at consumers' plants.

Redistilled slab zinc produced at secondary smelters totalled 2,700 tons, and included 600 tons of Intermediate grade, 1,200 tons of Brass Special, and 900 tons of Prime Western grades.

General imports of zinc in ores and concentrates increased to 45,800 tons. Receipts of this material from Australia and Peru increased substantially over May to more than offset losses in imports from Spain, Italy and Mexico. Slab zinc imports, chiefly from Canada, Belgium and Luxembourg, Peru and Mexico, were 17,700 tons. Exports of slab zinc to the United Kingdom, Brazil, Chile, and Canada totalled 150 tons.

Training Services in Industry

What some employers' organizations and joint bodies are doing in the way of providing training services for the benefit of the firms in their industries is described in a booklet, entitled "Training Services in Industry," just published by the Industrial Training Council. This is the first booklet published by the Council, which was set up a year ago to keep under review the recruitment and training of workpeople and to encourage, assist and inform industries about these matters.

This story of the development of training schemes and advisory services describes the main functions of such services under the headings "Provision of Information," "Practical Training and Training Aids," "Supervision of Training and Further Education," "Recruitment," "Selection and Induction," "Indenture and Registration," "Tests and Certificates" and "Research into Training Methods."

Copies of this useful booklet may be obtained from the offices of the Council at 36 Smith Square, London, S.W.1, price 1s. 6d.

Rare Earth Metals

Successful production of all rare earth metals has been achieved by **Johnson Matthey and Company Ltd.** The rare earth elements or "lanthanons" comprise the fifteen elements from lanthanon (atomic number 57) to lutetium (71). Scandium (21) and yttrium (39), the first two members of the same sub-group in the Periodic Table, are similar chemically and in their atomic structure. Element 61, promethium, does not occur naturally, but one of its isotopes has been isolated from the products of nuclear fission.

Together these closely related elements, with their compounds, form a hitherto little known but potentially valuable range of materials.

For some years active research on the rare earths has been carried out by Johnson Matthey, and supplies of the rare earths in their normal form as oxides have been available in several grades of purity. Improved techniques for the production of the metallic elements have now been brought to fruition, and all of the fourteen naturally occurring elements, together with the closely related elements scandium and yttrium, are now available in a variety of forms.

New Office Opened

On Wednesday last, **Morris Ashby Ltd,** opened a new office in Leeds at "Walmley", Layton Road, Rawdon, with the telephone number of Rawdon 101. Mr. R. P. Bartrum is leaving the company's Birmingham office to take over this new area in Leeds where he will also represent their associated company — Columbian International (Great Britain) Ltd.

Magnesium Alloys

Two new magnesium alloys have been introduced by **Magnesium Elektron Ltd.,** these being MSR, a new high strength magnesium casting alloy, and ZTY, a new magnesium wrought alloy.

These two alloys are described in booklets recently distributed by the company, together with diagrams and the requisite data. The MSR alloy is a fully-heat-treatable magnesium alloy based on the magnesium-rare earth metal-silver-zirconium system. Its advantages are set out in the booklet referred to.

ZTY is a magnesium wrought alloy for use at elevated temperatures, and is available as sheet, plate, extrusions and forgings. Its characteristics, applications, etc., with charts showing tensile properties, are dealt with in the booklet.

Change of Address

We are advised by **E.M.B. Company Ltd.** that, as from October 19 next, the address of their Sheffield office will be 88 Brincliffe Edge Road, Sheffield, 11. The telephone number remains the same —Sheffield 55278.

A Sales Appointment

It has been announced by **Chamberlain Industries Ltd.** that Mr. G. E. Hart has been appointed technical sales director of the company. Mr. Hart has been with the company for nearly twenty-five years, and has been primarily responsible for the "Staffa" range of tube and bar bending machines.

Outlook for Metals

Speaking to the New England division of the National Association of Waste Material Dealers meeting, held at Newton (Mass.), Mr. A. W. P. Trench, President of the metal trade daily, *American Metal Market*, said that the near term outlook for all non-ferrous metals was bullish, tied to the settlement of the steel strike. He said prices would be strong, with pressure upward.

Mr. Trench noted that copper remained the big question mark but at the same time, because of its marvellous and unequalled properties, it responded most favourably to a long overdue market programme. Copper producers must give much more support to the Copper and Brass Research Association in developing a cast, unified industry-wide market research and development programme for copper similar to that which had been the practice in aluminium in recent years. He contended that the copper producers had understandably been more concerned with the production and supply of copper than in seeing that there was a sustained demand for their product.

However, because of the impact of production from new mines and refineries in the next three years, once the steel strike was settled and the near-term demand satisfied (barring labour troubles, or stepped-up demand from the expanding European economy), he pointed out this increased production could well have a depressing effect on copper prices in the future.

The answer to this was a vast united industry-wide effort to find new markets for copper usage. Mr. Trench predicted a possible rise of a half cent per lb. in the price of lead in October, when lead consumption is expected to show an increase. He believed that the settlement of the steel strike could trigger a one per cent price advance in zinc, which statistically is in a sounder condition than lead.

Tin Statistics

World mine production of tin-in-concentrates in May, 1959, amounted to 11,500 tons, compared with 11,400 in April and 10,600 in March, the International Tin Council reports in the August issue of its monthly statistical bulletin. In June, production increased in Indonesia (2,016 tons) but fell slightly in the Federation of Malaya (2,909) and the Belgian Congo (855). Exports of tin-in-concentrates from Bolivia in June (2,054 tons), including tin moved on barter arrangements, were much the same as in the previous month.

Tin exports from Bolivia in June amounted to 1,200 tons, making a total of 4,527 for the sixth control period (April 1-June 30). Exports from the Federation of Malaya in the same period were 8,535 tons. In July, 1,307 tons were exported from the Belgian Congo and 817 tons from the Federation of Nigeria.

Electro-Magnetic Coils

It is reported from the U.S.A. that aluminium strip is about to make sizeable inroads into the electro-magnetic coil field—long dominated by copper wire—according to Mr. R. R. Cope, head of the strip conductor programme for the Aluminum Company of America. Since September, 1958, Alcoa has been making strip-wound coils in its research laboratories' transformer division. The bulk of these coils, the company said, have been wound to specifications supplied by some 150 coil manufacturers. Alcoa supplied these sample coils for testing and evaluation by the manufacturers, and the programme has been a major factor in directing attention to aluminium strip windings.

Current activities by over a dozen coil makers indicate that the aluminium-strip wound coils will soon become general market items, Mr. Cope added. Currently in regular production, or scheduled to go into production, are these types of strip-wound coil: dry-type distribution transformers; aircraft and electronic solenoids; motor vehicle alternators; clutch coils for heavy duty equipment; lifting magnets, and arc welding equipment.

A Golf Meeting

On Tuesday, September 29 next, the Autumn golf meeting of the **Royal Metal Trades Benevolent Society** will be held at the Harborne Golf Club, Birmingham, commencing at 8.30 a.m. The meeting will consist of a medal round in the morning, and a Foursomes medal round in the afternoon. During the day a putting competition will also be held.

The prizes will include the Coronation Challenge Cup for the best medal round;

a challenge cup for the best scratch score; the Cecil-Wright Challenge Cup for the best medal round for veterans over 55; a challenge cup for the best medal round made by a visiting pair from London and the Home Counties; while, in addition, there will be two challenge cups for the afternoon round and other prizes for runners-up, etc.

In view of the fact that the annual ball of the Society has to be arranged and booking fixed at least a year in advance, the Society has decided to adhere to the date fixed for this year's event, which was booked at the Grand Hotel, Birmingham, for October 8 next. This date coincides with the General Election and, in view of this, arrangements have been made to commence the proceedings an hour later —9.30 p.m.—and to continue until 2 a.m. The house management has also arranged for announcements to be made relating to the state of the parties at intervals during the evening.

Stockpile Requirements

A further report from the U.S.A. states that the Government's stockpile managers are planning to hold on to over 3,000 million dollars' worth of metals and minerals now considered surplus to emergency needs until a new study of the probable effects of atomic war is completed. This was stated by Mr. J. Roy Price, assistant director of the Office of Civil and Defense Mobilization, in a speech to the American Mining Congress. He said the study of stockpile needs following a nuclear attack would not be completed for about a year. However, he believed the study would show that at least some of the materials now considered surplus to war needs could be valuable in the event of an atomic attack.

At present, the federal stockpile was worth over 7,000 million dollars, Mr. Price said. It was designed to meet military and civilian needs during an emergency of up to three years. However, when it came to nuclear war involving an attack on the United States, there was no unanimity within the Government about what the size of the stockpile should be.

Fuel Economy

Early notice is being given of an important two-day Conference to discuss the application of automatic controls to the smaller industrial boiler plant burning solid fuel. The conference has been organized by the **Combustion Engineering Association,** and will be held at the Royal Hotel, Scarborough, on Tuesday and Wednesday, November 3 and 4 next.

The subject of the conference will be discussed from both the technical and economic aspects. Four technical sessions will be held, at which Papers on fuel and ash handling, combustion and mechanical firing, automatic control equipment, and present-day practice in automatic control will be presented and discussed, both at group meetings and in open sessions.

A final session will be devoted to an economic assessment of the use of automatic handling and control equipment, based on actual installations, with particular reference to installation costs, reduction in operating, labour and fuel costs, and the effect on general productivity.

A civic reception will be held for the delegates on the first evening by the Mayor and Corporation of Scarborough, whilst a conference dinner will be held on the second evening to which important guests have been invited. The conference is open to both members and non-members of the association, and those wishing to take part are advised to make an early request for an application form to the Director of the Association at 70 Jermyn Street, London, S.W.1.

Fire Prevention

Founded in 1946, the Fire Offices' Committee Fire Protection Association is the recognized central authority on fire protection. It makes available to the public an advisory service from which help and advice on every aspect of fire prevention and control may be obtained free of charge. The association, a non-profit making body, works in close collaboration with Government departments, the fire brigades, insurance companies, and the leading professional institutions, and its recommendations embody the results of national experience of fire and of research.

Full details of the association's work and the benefits of membership can be found in a new brochure just issued, and it includes the services it renders to industry. The engineering and general industry section of the association studies the fire hazards of industrial processes and services in a wide range of industries, handles all enquiries concerning these subjects and prepares publications concerning them. Other sections deal with such matters as hazardous chemicals, construction of buildings, and fire extinguishing equipment.

Copies of this brochure may be obtained from the offices of the association—31-45 Gresham Street, London, E.C.2.

Uses of Nickel

Included in the latest edition of Inco-Mond Magazine are articles on the uses of nickel steels in the Napier "Deltic" high-speed diesel engine; in oil-well pumps operating to a depth of 8,000 ft.; and in the Coventry Climax engine of the Cooper and Lotus racing cars. The varied uses of nickel-containing stainless steels includes articles on hospital equipment, swimming pool fittings, beer barrels, and pumps for chemical fluids.

Other articles include the use of Cronite pots and boxes to cut the costs of heat-treating operations; temperature measurement by platinum - rhodium thermocouples; a new type of battery for aircraft; and a survey of the uses of copper throughout recorded history.

The magazine is obtainable free on request to The Mond Nickel Co. Ltd.

Small Equipment Success

Successful use of two Wandess cylinder boring bars linked in tandem to provide a multi-boring unit has been reported to the sole selling agents for Wandess equipment, Stenor Ltd., a member of the **Firth Cleveland Group.** The application provides an alternative to a multi-headed static boring machine.

The boring bars used are Wandess 2A geared headed bars, of the standard type which incorporates a rigid boring head and a special tool lapping jig. They are accurate to 0·0002 in. ovality and taper, and produce a sleeving cut of 0·125 in. in one operation. The bore ranges between 2·2 in. and 4·2 in. dia. to a depth of 10½ in. at a maximum rate of cut of approximately 1·25 in. per minute. Smaller and larger models are available.

The application has been developed by Landmaster Ltd., of Hucknall, for the boring of two bush housings in the pressed casing enclosing the primary drive from motor to wheel axle of the new L.50 rotary cultivator. The boring bars are mounted on a jig which is, in turn, mounted on a boring table. The casing to be bored is held in place by five small hydraulic rams acting on suitably placed crossbars. Jig, boring table and pneumatic system were designed and assembled by Landmaster engineers.

Forthcoming Meetings

September 19 — The Non-Destructive Testing Society of Great Britain. Birmingham Branch. Engineering Centre, Stephenson Place, Birmingham. "Radiation Protection." R. F. Farr. 10 a.m.

September 21—Institute of Metal Finishing. London Branch. Northampton Polytechnic, St. John Street, London, E.C.1. "The Use of Titanium in Electrolytic Processes for Metal Finishing." A. O. F. Freund and A. H. Barber. 6.15 p.m.

September 22—Association of Bronze and Brass Founders. Lancashire and Cheshire Area. Engineers' Club, Albert Street, Manchester. "Costing a Casting." W. H. Davies. 5.30 p.m.

September 22—The Institution of Plant Engineers. South Wales Branch. South Wales Engineers' Institution, Park Place, Cardiff. Technical films on Lubrication and Fuel Oils, by courtesy of Shell-Mex and B.P. Ltd. 7.30 p.m.

September 25—The Institution of Plant Engineers. Birmingham Branch. Imperial Hotel, Temple Street, Birmingham. "Works Engineering." R. T. Wells. 7.30 p.m.

Metal Market News

THE political scene has rather stolen the thunder from the markets this week, but that is not to say that the Prime Minister's announcement of October 8 as the day for the General Election has in any way affected the non-ferrous metal markets, which have, in fact, been rather uninteresting. The copper strike in the United States has continued, and it is now fairly generally predicted that no end will come to this dispute before September 30 at the earliest. As to the steel strike, there were some signs last week that this might be entering on its final phase, but nothing concrete emerged in regard to a general settlement. In the States, the overall position is apparently favourable and the economy of the country in good shape. Last week, however, saw Wall Street in a reactionary mood, and for two or three consecutive days sharp losses were registered. The week, however, closed on a somewhat brighter note. In London, the Stock Exchange was initially upset by the news of the Election, but some recovery was seen. In the States, a split price developed in the producers' price for copper which, instead of 30 cents, was amended to 30 to 31½ cents. The effect on the London market was negligible. At the beginning of the week it became known that stocks of copper in Metal Exchange warehouses had declined by 1,031 tons to 14,963 tons. Initially the backwardation remained in being, but on Friday at midday cash and three months were quoted level at £232 10s. 0d., this proving to be the low point for the week. On the afternoon market, a backwardation of 10s. reappeared.

Trading last week in copper was rather slow, and the turnover in the standard market did not exceed 8,000 tons, while Kerb business probably did not add much to this total. After minor fluctuations in value, the close on Friday afternoon was £233 15s. 0d. cash and £233 5s. 0d. three months, prices showing a loss of £2 5s. 0d. in cash and £1 10s. 0d. in three months. One reason for the narrowing of the backwardation was doubtless the falling off in demand for cash copper as a result of fears that a longshoreman's strike on October 1 would interfere with arrivals of copper, but as we write the chances of a stoppage seem to have receded. It now seems pretty certain that practically every ton of available copper outside the States, either has been shipped or is earmarked for shipment to the other side to help out the supply situation in the States. Obviously producers cannot part with metal which is intended for delivery on scale contracts to consumers in Europe but any "loose" copper available has almost certainly been sold to the American market. This means, of course, that were any trouble to break out in Chile, the situation for consumers in this country at any rate, might well be very difficult. However, it is satisfactory to note, that judging from the latest advices, the chances of a strike at any of the Chilean copper properties are small.

Tin continues to remain on a level keel, but trading on the Metal Exchange in this metal is light. The close was £793 10s. 0d. for both cash and three months which meant a rise of 30s. in the forward position, spot metal being unchanged. Business in zinc was meagre and the turnover did not amount to more than 3,400 tons. At £86 15s. 0d. for September and £85 10s. 0d. for December, both positions registered an advance of 10s. Lead was much more active than zinc and some 7,750 tons changed hands, the close being £71 5s. 0d. for the current month and £72 7s. 6d. for December. On balance prompt declined by 15s. and forward by 17s. 6d.

Birmingham.

Steady progress is being made in the metal-using industries of the Midland area. Most branches of the engineering trade have picked up since the holiday period, and it is significant that there are more vacancies for skilled and semi-skilled men. The motor trade is the outstanding consumer of metals, and suppliers of components are kept busy in delivering supplies of castings, pressings, strip and other raw materials. The building trade is busy but in some instances activity has been held up through a shortage of bricks.

With a growing demand for supplies of steel it has been necessary to extend delivery dates for some products such as thin sheets, and reinforcing bars. For the first time for many months, some steelworks are back again to full capacity working, and it is believed that others will reach this position before the year is out. Even in the holiday month of August, output of steel was better than in the corresponding month of last year. The iron foundries are sharing in the revival and bigger demands are being made on the blast furnaces supplying pig iron. Consumption of billets is expanding consistent with greater activity in the re-rolling steel works. Heavy steel plate mills are steadily employed.

New York

During the week-end Commodity Exchange copper was steadier in the nearbys but a shade lower in more distant months. The volume of trading was moderate. Physical copper was quite steady, dealers offering at 34 cents and consumers bidding at 33¾ cents per lb. The lone custom smelter offering copper noted that demand at 33 cents was greater than available supplies. Traders noted that consumer demand for copper was gradually increasing. No new developments were reported from the non-ferrous strike front. No negotiations were taking place between the unions and the struck companies. Tin was steady and quiet. Lead and zinc were also quiet.

The Senate has approved two Bills establishing a new national minerals policy for the United States. Both Bills would instruct the Eisenhower Administration to advise Congress on what action it should take in the future to "foster and encourage the maintenance and development of a sound and stable domestic mining and minerals industry."

The aim of the two Bills is to protect United States industries from foreign competition and to make the U.S. as nearly self-sufficient as possible. One Bill is more formal and requires a Presidential signature. This has already passed the House of Representatives and now goes direct to President Eisenhower. The other does not need Presidential approval and has been forwarded to the House for consideration there. Under the Bills, the Secretary of the Interior is required to make an annual report to Congress on the status of what are described as the "depressed" domestic industries and to make any recommendations for legislation that might be needed.

Borneo

Highlight of mineral production in Sarawak, Brunei and North Borneo last year was provided by the new bauxite industry in Sarawak, states Dr. F. W. Roe, Director of Geological Survey for the three territories, in his latest report. He says that during 1958 the new industry of bauxite mining was launched successfully in Sarawak; prospecting for a new mineral (chromite) was begun in North Borneo; and prospecting for some of the territories' other mineral resources was stepped-up. He describes the economic results of geological work in the territories as a "bright feature" of 1958.

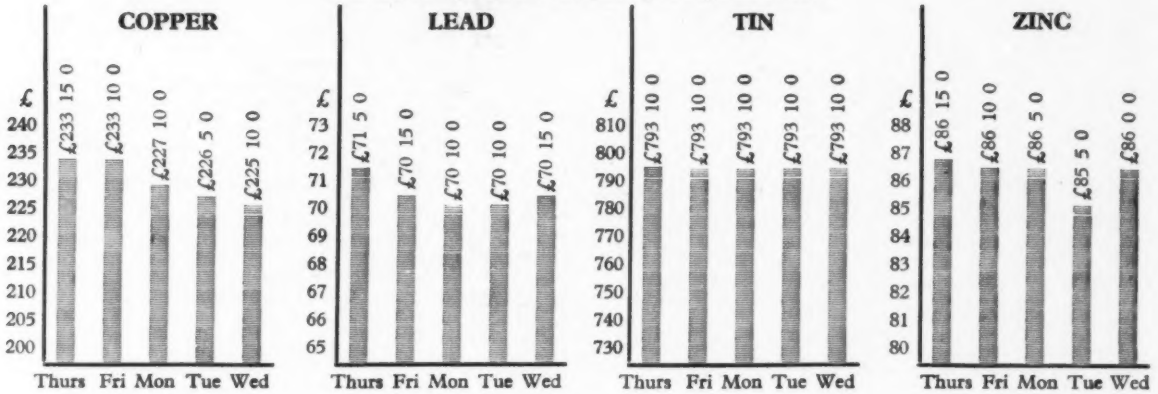
Mineral resources exported during the year were worth more than $349,300,000 (£40,752,000) and continued to represent about 70 per cent of the value of exports shipped. Revenue yield to the three Governments was $100,775,000 (£11,757,000).

Describing the successful launching of Sarawak's bauxite industry, the report says that initial mining and shipping difficulties at the new mine at Sematan were soon overcome. Ore produced totalled more than 136,000 tons, of which 99,930 tons, worth about $1,837,000 (£214,000, were exported.

Non-Ferrous Metal Prices

London Metal Exchange

Thursday 10 September to Wednesday 16 September 1959



Primary Metals

All prices quoted are those available at 2 p.m. 16/9/59

		£	s.	d.
Aluminium Ingots	ton	180	0	0
Antimony 99·6%	„	197	0	0
Antimony Metal 99%	„	190	0	0
Antimony Oxide	„	180	0	0
Antimony Sulphide Lump	„	190	0	0
Antimony Sulphide Black Powder	„	205	0	0
Arsenic	„	400	0	0
Bismuth 99·95%	lb.		16	0
Cadmium 99·9%	„		9	0
Calcium	„	2	0	0
Cerium 99%	„	16	0	0
Chromium	„		6	11
Cobalt	„		14	0
Columbite per unit			—	
Copper H.C. Electro	ton	225	10	0
Fire Refined 99·70%	„	224	0	0
Fire Refined 99·50%	„	223	0	0

		£	s.	d.
Copper Sulphate	ton	76	0	0
Germanium	grm.		—	
Gold	oz.	12	10	7½
Indium	„		10	0
Iridium	„	24	0	0
Lanthanum	grm.		15	0
Lead English	ton	70	15	0
Magnesium Ingots	lb.		2	3
Notched Bar	„		2	9½
Powder Grade 4	„		6	1
Alloy Ingot, A8 or AZ91	„		2	4
Manganese Metal	ton	245	0	0
Mercury	flask	71	10	0
Molybdenum	lb.	1	10	0
Nickel	ton	600	0	0
F. Shot	lb.		5	5
F. Ingot	„		5	6
Osmium	oz.		nom.	
Osmiridium	„		nom.	

		£	s.	d.
Palladium	oz.	7	5	0
Platinum	„	28	10	0
Rhodium	„	41	0	0
Ruthenium	„	18	0	0
Selenium	lb.		nom.	
Silicon 98%	ton		nom.	
Silver Spot Bars	oz.		6	7
Tellurium	lb.		15	0
Tin	ton	793	10	0
***Zinc**				
Electrolytic	ton		—	
Min 99·99%	„		—	
Virgin Min 98%	„	85	7	6
Dust 95/97%	„	114	0	0
Dust 98/99%	„	120	0	0
Granulated 99+%	„	110	7	6
Granulated 99·99+%	„	123	17	6

* *Duty and Carriage to customers' works for buyers' account.*

Foreign Quotations

Latest available quotations for non-ferrous metals with approximate sterling equivalents based on current exchange rates

	Belgium fr/kg ≏ £/ton	**Canada** c/lb ≏ £/ton	**France** fr/kg ≏ £/ton	**Italy** lire/kg ≏ £/ton	**Switzerland** fr/kg ≏ £/ton	**United States** c/lb ≏ £/ton
Aluminium		22.50 185 17 6	224 168 0	375 221 5	2.50 212 10	26.80 214 10
Antimony 99.0			230 171 10	445 262 10		29.00 232 0
Cadmium			1,300 975 0			120.00 960 0
Copper						
Crude						
Wire bars 99.9				455 268 10		
Electrolytic	32.50 239 5 0	29.00 238 12 6	327 245 2 6		2.75 233 17 6	30.00 240 0
Lead		10.75 88 12 6	103 77 2 6	165 97 7 6	.88 74 17 6	13.00 104 0
Magnesium						
Nickel		70.00 578 5	900 675 0	1,200 708 0	7.50 637 10	74.00 592 0
Tin	111.50 820 17 6		1,122 841 12 6	1,500 885 0	9.70 824 12 6	102.12 816 17 6
Zinc						
Prime western		11.75 97 0 0				11.00 88 0
High grade 99.95		12.35 102 0 0				
High grade 99.99		12.75 105 2 6				
Thermic			126.00 94 12 6			
Electrolytic			134.00 99 12 6	192 113 5	1.05 89 2 6	12.50 100 0

Non-Ferrous Metal Prices (continued)

Ingot Metals

All prices quoted are those available at 2 p.m. 16/9/59

Aluminium Alloy (Virgin)	£	s.	d.
B.S. 1490 L.M.5 .... ton	210	0	0
B.S. 1490 L.M.6 .... „	202	0	0
B.S. 1490 L.M.7 .... „	216	0	0
B.S. 1490 L.M.8 .... „	203	0	0
B.S. 1490 L.M.9 .... „	203	0	0
B.S. 1490 L.M.10.... „	221	0	0
B.S. 1490 L.M.11.... „	215	0	0
B.S. 1490 L.M.12.... „	223	0	0
B.S. 1490 L.M.13.... „	216	0	0
B.S. 1490 L.M.14.... „	224	0	0
B.S. 1490 L.M.15.... „	210	0	0
B.S. 1490 L.M.16.... „	206	0	0
B.S. 1490 L.M.18.... „	203	0	0
B.S. 1490 L.M.22.... „	210	0	0
Aluminium Alloys (Secondary)			
B.S. 1490 L.M.1 .... ton	152	0	0
B.S. 1490 L.M.2 .... „	162	0	0
B.S. 1490 L.M.4 .... „	178	0	0
B.S. 1490 L.M.6 .... „	188	0	0
***Aluminium Bronze**			
BSS 1400 AB.1..... ton	233	0	0
BSS 1400 AB.2..... „	246	0	0

*Brass	£	s.	d.
BSS 1400-B3 65/35 .. ton	152	0	0
BSS 249 ..... „	—		
BSS 1400-B6 85/15 .. „	197	0	0
***Gunmetal**			
R.C.H. 3/4% ton .... „	—		
(85/5/5/5) LG2 ..... „	188	0	0
(86/7/5/2) LG3 ..... „	197	0	0
(88/10/2/1) ..... „	237	0	0
(88/10/2/½) ..... „	249	0	0
***Manganese Bronze**			
BSS 1400 HTB1.... „	184	0	0
BSS 1400 HTB2.... „	197	0	0
BSS 1400 HTB3.... „	210	0	0
Nickel Silver			
Casting Quality 12% „	225	0	0
„ „ 16% „	232	0	0
„ „ 18% „	245	0	0
***Phosphor Bronze**			
B.S. 1400 P.B.1.(A.I.D. released) ..... „	286	0	0
B.S. 1400 L.P.B.1 .... „	206	0	0

**Average prices for the last week-end.*

Phosphor Copper	£	s.	d.
10% ..... ton	253	0	0
15% ..... „	255	10	0
Phosphor Tin			
5%	—		
Silicon Bronze			
BSS 1400-SB1 . .... „	238	0	0
Solder, soft, BSS 219			
Grade C Tinmans.... „	368	15	0
Grade D Plumbers.. „	296	10	0
Grade M ..... „	405	0	0
Solder, Brazing, BSS 1845			
Type 8 (Granulated) lb.	—		
Type 9 „ „	—		
Zinc Alloys			
Mazak III ..... ton	117	2	6
Mazak V ..... „	121	2	6
Kayem ..... „	127	2	6
Kayem II ..... „	133	2	6
Sodium-Zinc ..... lb.		2	7½

Semi-Fabricated Products

Prices vary according to dimensions and quantities. The following are the basis prices for certain specific products.

Aluminium				£	s.	d.
Sheet	10	S.W.G.	lb.		2	8½
Sheet	18	S.W.G.	„		2	10½
Sheet	24	S.W.G.	„		3	1½
Strip	10	S.W.G.	„		2	8½
Strip	18	S.W.G.	„		2	9½
Strip	24	S.W.G.	„		2	11
Circles	22	S.W.G.	„		3	2½
Circles	18	S.W.G.	„		3	1½
Circles	12	S.W.G.	„		3	0½
Plate as rolled			„		2	8
Sections			„		3	2
Wire 10 S.W.G.			„		2	11½
Tubes 1 in. o.d. 16 S.W.G.			„		4	1
Aluminium Alloys						
BS1470. HS10W.						
Sheet	10	S.W.G.	„		3	1
Sheet	18	S.W.G.	„		3	3½
Sheet	24	S.W.G.	„		3	11
Strip	10	S.W.G.	„		3	1
Strip	18	S.W.G.	„		3	2½
Strip	24	S.W.G.	„		3	10½
BS1477. HP30M. Plate as rolled.....			„		2	11
BS1470. HC15WP.						
Sheet	10	S.W.G.	„		3	9½
Sheet	18	S.W.G.	„		4	2
Sheet	24	S.W.G.	„		5	0½
Strip	10	S.W.G.	„		3	10½
Strip	18	S.W.G.	„		4	2
Strip	24	S.W.G.	„		4	9½
BS1477. HPC15WP. Plate heat treated..			„		3	6½
BS1475. HG10W. Wire	10	S.W.G.	„		3	10½
BS1471. HT10WP. Tubes 1 in. o.d. 16 S.W.G.			„		5	0½
BS1476. HE10WP. Sections			„		3	1½
Brass						
Tubes.....			„		1	10½
Brazed Tubes.....			„		3	0
Drawn Strip Sections			„		3	0½
Sheet			ton	199	5	0
Strip			„	199	5	0
Extruded Bar.....			lb.		2	0½
Extruded Bar (Pure Metal Basis)			„		—	

Brass		£	s.	d.
Condenser Plate (Yellow Metal)	ton	193	0	0
Condenser Plate (Naval Brass)	„	205	0	0
Wire	lb.		2	7½
Beryllium Copper				
Strip	„	1	4	11
Rod.....	„	1	1	6
Wire	„	1	4	9
Copper				
Tubes	lb.		2	2½
Sheet	ton	256	0	0
Strip	„	256	0	0
Plain Plates	„	—		
Locomotive Rods	„	—		
H.C. Wire	„	283	5	0
Cupro Nickel				
Tubes 70/30	lb.		3	6½

Lead		£	s.	d.
Pipes (London)	ton	111	5	0
Sheet (London)	„	109	0	0
Tellurium Lead	„	£6 extra		
Nickel Silver				
Sheet and Strip 7% ..	lb.		3	8½
Wire 10%	„		4	3½
Phosphor Bronze				
Wire	„		4	0½
Titanium (1,000 lb. lots)				
Billet 4½" to 18" dia...	lb.	54/-		55/-
Rod ¼" to 4" dia.	„	95/-		62/-
Wire ·036" – ·232" dia.	„	167/-		110/-
Strip ·003" to ·048" ..	„	200/-		75/-
Sheet 8'×2'. 20 gauge	„	85/-		
Tube, representative average gauge.....	„	300/-		
Extrusions	„	105/-		
Zinc				
Sheet	ton	120	10	0
Strip	„	nom.		

Domestic and Foreign

Merchants' average buying prices delivered, per ton, 15/9/59.

Aluminium	£
New Cuttings	147
Old Rolled	128
Segregated Turnings	101
Brass	
Cuttings	157
Rod Ends	146
Heavy Yellow	121
Light	115
Rolled	149
Collected Scrap	118
Turnings	140
Copper	
Wire	207
Firebox, cut up	199
Heavy	194
Light	188
Cuttings	207
Turnings	189
Braziery	158

Gunmetal	£
Gear Wheels	173
Admiralty.....	173
Commercial	159
Turnings	154
Lead	
Scrap	61
Nickel	
Cuttings	—
Anodes	550
Phosphor Bronze	
Scrap	159
Turnings	154
Zinc	
Remelted	75
Cuttings	61
Old Zinc	40

Financial News

Aluminium Corporation

Trading profit, etc., for 7 months ended July 31, 1959, £158,481 (£218,192 for full year). Depreciation—due to a change in the basis of calculation, charge includes £14,000 additional depreciation — £39,985 (£23,600) and tax £52,700 (£95,000), net profit £55,337 (£81,596). Add tax adjustment £3,031 (nil). To plant replacements reserve £10,000 (£20,000 and general reserve £30,000). Dividend 10 per cent and golden jubilee bonus 5 per cent £27,563 (17½ per cent £30,187). Additional future tax £27,000 (nil). Forward £34,686 (£40,881).

Charles Carr Ltd.

Final dividend of 5 per cent, making 12½ per cent for the year (same). Profits for the year ended June 30 were £5,378 against £7,322 for 1957-58, after allowing for tax of £6,596 (£10,015), and provision for deferred repairs of £2,500 (nil).

New Companies

The particulars of companies recently registered are quoted from the daily register compiled by Jordan and Sons Limited, Company Registration Agents, Chancery Lane, W.C.2.

W. J. Watts and Company Limited (633802), 253A Cranbrook Road, Gants Hill, Ilford. Registered July 29, 1959. To carry on business of machinery, metal and waste paper merchants, marine store dealers, etc. Nominal capital, £500 in £1 shares. Directors: Stanley J. Hitchcock, Wm. J. Watts and Mary Watts.

Jaywood Electro Plating Company Ltd. (634495), 187 High Street, Brentford, Middx. Registered August 6, 1959. Nominal capital, £1,000 in £1 shares. Directors: John H. Wood and Ena D. Wood.

Metal Products (C. L. Barton) Limited (634637), 91 Tudor Avenue, Worcester Park, Surrey. Registered August 7, 1959. Nominal capital, £2,000 in £1 shares. Permanent directors: Charles L. Barton and Emily V. Barton

R. G. and D. G. Searle Limited (635159), 32a Lauriston Road, E.9. Registered August 17, 1959. To carry on business of machinery and metal merchants, etc. Nominal capital, £1,000 in £1 shares. Directors: Ronald G. Searle and Dennis G. Searle, junr.

Willdon Metal Products Limited (635198), 33 Victoria Road, Surbiton, Surrey. Registered August 17, 1959. To carry on the business of mechanical and general engineers, etc. Nominal capital, £100 in £1 shares. Directors: Wilfred A. Griffin and Donald W. Norsworthy.

Albert Haigh and Son Limited (635452), Firth Street, Huddersfield. Registered August 21, 1959. To carry on business of machinery and metal merchants, marine store dealers, etc. Nominal capital, £5,000 in £1 shares. Directors: Granville Haigh, Joshua W. Heap, Mrs. Carrie Haigh and Mrs. Brenda Heap.

Hogg and Briggs Limited (635504), 23-25 Bedford Street, Leicester. Registered August 21, 1959. To carry on business of manufacturers of rosin-cored solder, and articles of non-ferrous metals, etc. Nominal capital, £2,000 in £1 shares. Directors not named.

E. L. Forester and Company Limited (635689), Midland Bank Chambers, Bute Street, Cardiff. Registered August 25, 1959. To take over business of importers, exporters and workers in metals and minerals known as "E. L. Forester and Co." and carried on by Dwynwyn E. Jones at Swansea, etc. Nominal capital, £5,000 in £1 shares. Directors to be appointed by subscribers.

Metallic Coatings Limited (635760), Small Lane, Mobberley, Knutsford, Ches. Registered August 26, 1959. Nominal capital, £1,000 in £1 shares. Directors: Peter Waterhouse, Geoffrey Ainley, Michael Waterhouse, Edward Dillon and Oliver D. B. Coe.

Montford Metal Finishing Company Limited (635789), 360 Kennington Road, S.E.11. Registered August 26, 1959. Nominal capital, £100 in £1 shares. Directors: George Korosi and Dorothy R. Barton.

Anodising Research and Development Organisation Limited (635948), 115-120 Abbey House, Westminster, S.W.1. Registered August 28, 1959. Nominal capital, £100 in £1 shares. Directors: Wm. A. Prestage and Thomas O. D. Craig.

Butterworths (Regia) Limited (635952), Regia Works, Albert Street, Ramsgate. Registered August 28, 1959. To carry on the business of electro, nickel and chromium platers, etc. Nominal capital, £2,000 in £1 shares. Directors: Henry F. Butterworth and Peter J. Butterworth.

Trade Publications

Machine Tools.—A. A. Jones and Shipman Ltd., Leicester.

In an eight-page brochure this company devotes space to the precision finishing and productivity side of its business. Precision grinding machines are detailed and illustrations of machines installed.

Gaseous Nitrogen. — The Incandescent Heat Company Ltd., Cornwall Road, Smethwick, Birmingham.

A reprint of an article written by Mr. Golding, the manager of this company's gas atmospheres division, on the commercial production of gaseous nitrogen has been distributed. Illustrations are included with the data given. With this reprint, a product directory of the division is also given.

Light Metal Statistics

Figures showing the U.K. production, etc., of light metals for May, 1959, have been issued by the Ministry of Supply as follows (in long tons):—

Virgin Aluminium	
Production	1,846
Imports	14,704
Despatches to consumers	16,954
Secondary Aluminium	
Production	9,432
Virgin content of above	1,031
Despatches (including virgin content)	9,908
Scrap	
Arisings	12,288
Estimated quantity of metal recoverable	8,779
Consumption by:	
(a) Secondary smelters	11,205
(b) Other uses	919
Despatches of wrought and cast products	
Sheet, strip and circles	13,443
Extrusions (excluding forging bar, wire-drawing rod and tube shell):	
(a) Bars and sections	2,850
(b) Tubes (i) extruded	160
(ii) cold drawn	471
(c) (i) Wire	2,197
(ii) Hot rolled rod (not included in (c) (i)	68
Forgings	322
Castings: (a) Sand	1,602
(b) Gravity die	3,914
(c) Pressure die	1,750
Foil	1,993
Paste	294
Magnesium Fabrication	
Sheet and strip	4
Extrusions	64
Castings	150
Forgings	6

Scrap Metal Prices

The figures in brackets give the English equivalents in £1 per ton:—

West Germany (D-marks per 100 kilos):		
Used copper wire	(£205.17.6)	235
Heavy copper	(£201.10.0)	230
Light copper	(£170.17.6)	195
Heavy brass	(£118.5.0)	135
Light brass	(£96.12.6)	105
Soft lead scrap	(£56.0.0)	64
Zinc scrap	(£38.12.6)	44
Used aluminium unsorted	(£105.2.6)	120
France (francs per kilo):		
Electrolytic copper scrap	(£198.15.0)	265
Heavy copper	(£198.15.0)	265
No. 1 copper wire	(£183.15.0)	245
Brass rod ends	(£127.12.6)	170
Zinc castings	(£51.0.0)	68
Lead	(£69.0.0)	92
Aluminium	(£129.12.6)	173

Italy (lire per kilo):		
Aluminium soft sheet clippings (new)	(£200.15.0)	340
Aluminium copper alloy	(£135.17.6)	230
Lead, soft, first quality	(£79.0.0)	134
Lead, battery plates	(£44.5.0)	75
Copper, first grade	(£221.5.0)	375
Copper, second grade	(£209.10.0)	355
Bronze, first quality machinery	(£203.2.6)	345
Bronze, commercial gunmetal	(£174.10.0)	295
Brass, heavy	(£147.12.6)	250
Brass, light	(£237.17.6)	225
Brass, bar turnings	(£135.17.6)	230
New zinc sheet clippings	(£65.0.0)	110
Old zinc	(£50.2.6)	85

THE STOCK EXCHANGE

Steels Became Uncertain In Tendency Following Slight Recovery

ISSUED CAPITAL •	AMOUNT OF SHARE	NAME OF COMPANY	MIDDLE PRICE 14 SEPTEMBER	+RISE—FALL	DIV. FOR LAST FIN. YEAR	DIV. FOR PREV. YEAR	DIV. YIELD	1959 HIGH	1959 LOW	1958 HIGH	1958 LOW
£	£				Per cent	Per cent					
4,435,792	1	Amalgamated Metal Corporation ...	27/–	+3d.	9	9	6 13 3	27/4½	23/3	24/9	17/6
400,000	2/–	Anti-Attrition Metal	1/3		4	8½	6 15 0	1/6	1/3	1/9	1/3
41,303,829	Stk. (£1)	Associated Electrical Industries ...	60/3	+3d.	15	15	4 19 6	63/6	54/–	58/9	46/6
1,613,280	1	Birfield	58/6	—1/–	15	15	5 2 6	60/–	46/9	62/4½	46/3
3,196,667	1	Birmid Industries	81/3		17½	17½	4 6 3	82/–	72/–	77/6	55/3
5,630,344	Stk. (£1)	Birmingham Small Arms	45/6	+6d.	11	10	4 16 9	48/3	36/1½	39/–	23/9
203,150	Stk. (£1)	Ditto Cum. A. Pref. 5%	15/6		5	5	6 9 0	16/3	15/–	16/1½	14/7½
350,580	Stk. (£1)	Ditto Cum. B. Pref. 6%	18/10½		6	6	6 7 0	18/10½	17/9	17/4½	16/6
500,000	1	Bolton (Thos.) & Sons	33/9		10	10	5 18 6	34/–	27/6	28/9	24/–
300,000	1	Ditto Pref. 5%	15/6		5	5	6 9 0	15/6	14/–	16/–	15/–
160,000	1	Booth (James) & Co. Cum. Pref. 7%	20/6		7	7	6 16 6	20/6	20/–	20/4½	19/–
1,500,000	Stk. (£1)	British Aluminium Co. Pref. 6% ...	20/6		6	6	5 17 6	20/7½	18/9	20/–	18/4½
17,247,070	Stk. (£1)	British Insulated Callender's Cables	52/–	—9d.	12½	12½	4 16 3	57/–	46/3	52/6	38/9
17,047,166	Stk. (£1)	British Oxygen Co. Ltd., Ord. ...	65/6	+3/–	10	10	3 1 0	66/9	49/3	52/–	28/3
1,200,000	Stk. (5/–)	Canning (W.) & Co.	14/6	—3d.	25+*2½C‡	25	4 6 3	16/–	12/3	25/3	19/3
60,484	1/–	Carr (Chas.)	2/9	—1½d.	12½	25	4 11 0	2/10½	1/3	2/3	1/4½
555,000	1	Clifford (Chas.) Ltd.	26/6	—6d.	10	10	7 11 0	27/–	22/6	22/–	16/–
45,000	1	Ditto Cum. Pref. 6%	17/–		6	6	7 1 3	16/9	15/3	16/–	15/–
250,000	2/–	Coley Metals	3/–		15	20	10 0 0	4/–	2/10½	4/6	2/6
10,185,696	1	Cons. Zinc Corp.†	63/9	—9d.	15	18‡	4 14 0	69/3	59/–	65/3	41/–
1,509,528	1	Davy & United	79/–	+7/–	30‡	20	3 16 0	79/–	43/1½	87/–	45/9
6,840,000	5/–	Delta Metal	18/–	+4½d.	31‡	30	4 6 0	18/–	12/–	25/–	17/7½
5,296,550	Stk. (£1)	Enfield Rolling Mills Ltd.	56/7½	+10½d.	15	12½	5 6 0	57/6	36/7½	38/–	22/9
750,000	1	Evered & Co.	35/9		10§	15Z	5 12 0	35/9	30/–	30/–	26/–
18,000,000	Stk. (£1)	General Electric Co.	40/–	+1/9	10	10P	5 0 0	40/3	30/–	40/6	29/6
1,500,000	Stk. (10/–)	General Refractories Ltd.	36/9	—3d.	20	20	5 8 9	40/–	32/6	39/3	27/3
401,240	1	Gibbons (Dudley) Ltd.	63/6		16½	15	5 4 0	66/6	63/6	67/6	61/–
750,000	5/–	Glacier Metal Co. Ltd.	8/–	—3d.	11½	11½	7 3 9	9/3	6/7½	8/3	5/–
1,750,000	5/–	Glynwed Tubes	22/4½	—7½d.	20	20	4 9 6	23/–	16/4½	18/1½	12/10½
5,421,049	10/–	Goodlass Wall & Lead Industries ...	40/3	+3d.	13‖	18Z	3 4 6	40/3	28/7½	30/9	17/3
342,195	1	Greenwood & Batley	105/–		30	20	5 14 3	108/3	75/–	57/9	45/–
396,000	5/–	Harrison (B'ham) Ord.	19/10½	+7½d.	*17½	*15	4 8 0	20/–	14/11½	15/9	11/6
150,000	1	Ditto Cum. Pref. 7%	19/6		7	7	7 3 6	19/6	19/3	19/9	18/4½
1,075,167	5/–	Heenan Group	9/9	—1½d.	10	10‡	5 2 6	10/6	7/6	9/7½	6/9
236,958,260	Stk. (£1)	Imperial Chemical Industries ...	41/–	+1/6	12Z	10	3 18 0	42/9	33/9	38/–	24/3
34,736,773	Stk. (£1)	Ditto Cum. Pref. 5%	17/1½	—3d.	5	5	5 16 9	17/9	16/–	17/1½	16/–
14,584,025	••	International Nickel	173	—1	$2.60	$3.75	2 16 9	187⅜	154½	169	132⅜
300,000	1	Johnson, Matthey & Co. Cum. Pref. 5%	16/3		5	5	6 3 0	16/3	15/4½	16/9	15/–
6,000,000	1	Ditto Ord.	43/–	—1/3	12D	10	3 14 6	44/3	29/7½	47/–	36/6
600,000	10/–	Keith, Blackman	31/3		17½E	15	4 7 0	31/3	25/–	28/9	15/–
320,000	4/–	London Aluminium	6/4½	+1½d.	10	10	6 5 6	6/9	5/3	6/–	3/–
765,012	1	McKechnie Brothers Ord.	43/9		15	15	6 17 0	45/–	41/–	45/–	32/–
1,530,024	1	Ditto A Ord.	42/–		15	15	7 2 9	43/6	38/9	45/–	30/–
1,108,268	5/–	Manganese Bronze & Brass	14/6		20⅝	20	7 3 6	16/3	13/9	14/1½	8/9
50,628	6/–	Ditto (7½% N.C. Pref.)	6/–		7½	7½	7 10 0	—	—	6/3	5/6
13,098,855	Stk. (£1)	Metal Box	62/6	+2/3	11	11	3 10 6	62/6	44/7½	73/3	40/6
415,760	Stk. (2/–)	Metal Traders	11/6	—6d.	50	50	8 14 0	12/3	8/4½	9/–	6/3
160,000	1	Mint (The) Birmingham	28/–		10	10	7 2 9	28/–	22/–	22/9	19/–
80,000	5	Ditto Pref. 6%	80/–		6	6	7 10 0	75/6	69/–	83/6	69/–
3,705,670	Stk. (£1)	Morgan Crucible A	57/6	—1/–	10	10	3 9 6	58/6	43/6	45/–	34/–
1,000,000	Stk. (£1)	Ditto 5½% Cum. 1st Pref. ...	18/–		5½	5½	6 2 3	18/6	17/6	18/–	17/–
2,200,000	Stk. (£1)	Murex	50/9		15	17½	5 18 3	51/–	41/–	58/9	46/–
468,000	5/–	Ratcliffs (Great Bridge)	11/6		10R	10	3 5 3	11/6	9/6	11/1½	6/10½
234,960	10/–	Sanderson Bros. & Newbould ...	41/–		25	20	6 2 0	41/–	27/9	27/3	24/6
1,365,000	Stk. (5/–)	Serck	23/–	+6d.	15	17½	3 5 3	23/–	18/–	18/7½	11/–
6,698,586	Stk. (£1)	Stone-Platt Industries	51/3		15	15	5 17 0	53/6	42/6	45/6	22/6
2,928,963	Stk. (£1)	Ditto 5½% Cum. Pref.	17/6		5½	5½	6 5 9	18/–	15/10½	16/3	12/7½
18,255,218	Stk. (£1)	Tube Investments Ord.	90/–	+1/3	17½	15	3 17 9	91/6	72/–	86/–	48/4½
41,000,000	Stk. (£1)	Vickers	30/6	—6d.	10	10	6 11 3	37/–	29/9	36/3	28/9
750,000	Stk. (£1)	Ditto Pref. 5%	15/–		5	5	6 13 9	15/0½	14/3	15/9	14/3
6,863,807	Stk. (£1)	Ditto Pref. 5% tax free	22/6	+6d.	*5	*5	6 12 9A	22/7½	20/6	23/–	21/3
2,200,000	1	Ward (Thos. W.), Ord.	100/–	—1/–	20	15	4 0 0	101/–	83/–	87/3	70/9
2,666,034	Stk. (£1)	Westinghouse Brake	48/3	+1/6	10	10	4 3 0	48/3	39/9	46/6	32/6
225,000	2/–	Wolverhampton Die-Casting ...	9/9	—1½d.	30	25	6 3 0	10/6	8/8½	10/1½	7/–
591,000	5/–	Wolverhampton Metal	29/9		27½	27½	4 12 6	32/3	21/6	22/9	14/9
78,465	2/6	Wright, Bindley & Gell	6/9	—3d.	20	20	7 8 3	7/1½	4/11½	5/4½	2/9
124,140	1	Ditto Cum. Pref. 6%	13/9		6	6	8 14 9	13/9	13/6	13/–	11/3
150,000	1/–	Zinc Alloy Rust Proof	3/1½	—3d.	27	40D	8 12 9	3/9	2/9	3/1½	2/7½

*Dividend paid free of Income Tax. †Incorporating Zinc Corpn. & Imperial Smelting. **Shares of no Par Value. ‡ and 100% Capitalized issue. • The figures given relate to the issue quoted in the third column. A Calculated on £7 8 9 gross. Y Calculated on 11½% dividend. ‖Adjusted to allow for capitalization issue. E for 15 months. D and 50% capitalized issue. Z and 50% capitalized issue. B equivalent to 12½% on existing Ordinary Capital after 100% capitalized issue. ϕ And 100% capitalized issue. X Calculated on 17½%. C Paid out of Capital Profits. E and 50% capitalized issue in 7% 2nd Pref. Shares. P Interim dividend since reduced. § And Special distribution of 2½% free of tax. R And 33⅓% capitalized issue in 8% Maximum Ordinary 5/– Stock Units.

Rate: Advertisements set in run-on style **4d.** per word, minimum **4/–**. Semi-displayed announcements are charged at **22/6** per inch depth. Box Numbers: add 5 words, plus 1/– for registration and forwarding replies. "Copy" accepted at London Office up to 1st post on each Friday for the following Friday's issue.

METAL INDUSTRY
CLASSIFIED ADVERTISEMENTS

Trade Discounts: Details upon application to "Metal Industry," Dorset House, Stamford Street, London, S.E.1. Remittances payable to Iliffe & Sons Ltd. The proprietors retain the right to refuse or withdraw "copy" at their discretion and accept no responsibility for matters arising from clerical or printers' errors.

APPOINTMENTS VACANT

HUNTS. EDUCATION COMMITTEE.
FLETTON SECONDARY MODERN SCHOOL (PETERBOROUGH).

APPLICATIONS are invited from suitably qualified teachers for appointment as Metal-work Master at this newly re-organized school of about 700 pupils. Forms of application may be obtained from the undersigned and should be returned, duly completed, as soon as possible.
IAN C. CURREY
Director of Education.
Gazeley House,
Huntingdon. [7858

SMALL concern requires experienced man to maintain and operate 1,000-ton Extrusion Press. R. & J. Briggs Ltd., Marjorie Street, Leicester. [7862

LONDON Metal Merchants have a vacant position, with excellent prospects, for an energetic young man experienced in buying and selling non-ferrous scrap. Willing to travel. Please write, giving full details, to Box 4770, c/o Metal Industry. [7843

METALLURGICAL Chemist. Sparklets Limited have an interesting vacancy in their modern laboratory. The successful applicant will need to have experience in the analysis by up-to-date methods of non-ferrous alloys, and the analytical control of plating solutions will be an advantage. Salary between £600 and £700 p.a. Retirement pension and dependants' insurance. Write, giving age and details of qualifications and experience, to Personnel Manager, Sparklets Limited, Queen Street, Tottenham, London, N.17. [7860

APPOINTMENTS WANTED

CHIEF Chemist, eight years large non-ferrous lab., seeks change; willing to start new lab. Box 4932, c/o Metal Industry. [7859

ADVERTISING Manager, declared redundant in recent "take-over" shuffle, seeks new post. Here are some facts about myself:—Age 53, M.A.A., M.I.A.M.A., A.I.P.A. (1937 vintage). Sound advertising agency background. Past twenty-five years spent in technical and industrial advertising (two companies). Seasoned advertising executive accustomed to working harmoniously with all departments. Good organizer with exceptional ability at strict budgetary control. First-class experience planning and executing press campaigns in U.K. and overseas. Creative writer and layout man with lots of experience converting dull subjects into lively and effective publicity by way of press, sales literature, direct mail, display and exhibitions, press and public relations, film distribution, photography and art work. Knowledgeable and enthusiastic hard-worker. Highest references supplied. Salary, about £2,000 but subject to negotiation. Box 4985, c/o Metal Industry. [7863

CAPACITY AVAILABLE

WORK wanted for 1,000 ton Extrusion Press and 35 ft. Drawbench, Midlands. Box 4960, c/o Metal Industry. [7861

SHEET Metal Work, Metal Spinning, Deep Drawn Pressings, Stamping Press capacity 200 tons. Max. draw 15". Enquiries or specifications to Wades (Halifax) Ltd., Arden Works, Fenton Road, Halifax. [0019

KELLERING and Cam Profiling Capacity up to 8 ft. × 6 ft., or 6 ft. diameter.
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